597

Vol. 19 JULY, 1925 No. 1

QUARTERLY

OF THE

National Fire Protection Association

Entered as second-class matter May 1, 1911, at the Post Office at Boston, Mass., under act of July 16th, 1894.

40 CENTRAL STREET, BOSTON, MASS.

National Fire Protection Association

INTERNATIONAL.

Executive Office, 40 Central Street, Boston, Mass., U. S. A.

OFFICERS

Rudolph P. Miller, *President*
Franklin H. Wentworth, *Secretary*
R. S. Moulton, *Assistant Secretary*

Dana Pierce, *First Vice-President*
Allen M. Schoen, *Second Vice-President*
Albert T. Bell, *Chairman Executive Committee*

Members

American Institute of Architects.
American Institute of Electrical Engineers.
American Association of Oil Burner Manufacturers.
American Concrete Institute.
American Electric Railway Association.
American Gas Association.
American Marine Insurance Syndicates.
American Petroleum Institute.
American Spice Trade Association.
American Water Works Association.
Arkansas Fire Prevention Bureau.
Associated Factory Mutual Fire Insurance Companies, Inspection Department.
Associated Lumber Mutual Fire Insurance Companies, Inspection Department.
Associated Manufacturers of Electrical Supplies.
Associated Metal Lath Manufacturers.
Association of Edison Illuminating Companies.
Association of Electragists.
Association of the Fire Alarm Industry.
Association of Fire Underwriters of Baltimore City.
Association of Marine Underwriters of United States.
Board of Fire Underwriters of Allegheny County.
Board of Fire Underwriters of the Pacific.
Board of Fire Underwriters of the Territory of Hawaii.
Boston Board of Fire Underwriters.
British Columbia Fire Underwriters' Association.
Bureau of Explosives.
Canadian Automatic Sprinkler Association.
Canadian Fire Underwriters' Association.
Canadian Manufacturers' Association.
Central Actuarial Bureau.
Central Station Fire Protection Association.
Chicago Board of Underwriters.
Clay Products Association.
Common Brick Manufacturers' Association of America.
Compressed Gas Manufacturers' Association.
Cotton Insurance Association.
Eastern Clay Products Association.
Electric Power Club.
Electrical Porcelain Manufacturers' Association.
Electrical Supply Jobbers' Association.
Engineering Institute of Canada.
Factory Insurance Association.
Factory Mutual Laboratories.
Federation of Mutual Fire Insurance Companies.
Fire Equipment Manufacturers' Institute.
Fire Marshals Association of North America.
Fire Underwriters' Electrical Bureau.
Gas Products Association.
Grain Insurance Association.
Gypsum Industries.
Hollow Building Tile Association.
Hydraulic Society.
Idaho Surveying and Rating Bureau.
Illinois Inspection Bureau.
Improved Risk Mutuals.
Indiana Inspection Bureau.
Institute of Radio Engineers.
Institute of Makers of Explosives.
Insurance Association of Providence.
International Acetylene Association.
International Association of Fire Engineers.
International Association of Fire Fighters.
International Association of Municipal Electricians.
International Brotherhood of Electrical Workers.
Iowa Insurance Service Bureau.
Kansas Inspection Bureau.
Kentucky Actuarial Bureau.
Kentucky State Dept. of Fire Prevention and Rates.
Lightning Rod Manufacturers' Association.
Louisiana Fire Prevention Bureau.
Michigan Inspection Bureau.
Millers' National Federation.
Mississippi State Rating Bureau.
Missouri Inspection Bureau.
Motion Picture Producers and Distributors of America, Inc.
Mountain States Inspection Bureau.
Mutual Fire Inspection Bureau.
Mutual Fire Insurance Association.
Mutual Fire Prevention Bureau.
National Association of Building Owners and Managers.
National Association of Credit Men.
National Association of Dyers and Cleaners.
National Association of Insurance Agents.
National Association of Manufacturers of Approved Hollow Metal Window Frames and Sash.
National Association of Manufacturers of United States.
National Association of Sheet Metal Contractors of United States.
National Association of Steel Furniture Manufacturers.
National Automatic Sprinkler Association.
National Board of Fire Underwriters.
National Convention of Insurance Commissioners.
National Electric Light Association.
National Lumber Manufacturers' Association.
National Petroleum Association.
National Wholesale Druggists' Association.
Nebraska Inspection Bureau.
New Brunswick Board of Fire Underwriters.
New England Bureau of United Inspection.
New England Insurance Exchange.
New Hampshire Board of Underwriters.
New Jersey Schedule Rating Office.
New York Board of Fire Underwriters.
New York Fire Insurance Rating Organization.
Newfoundland Board of Fire Underwriters.
Nova Scotia Board of Fire Underwriters.
Ohio Inspection Bureau.
Oil Insurance Association.
Oklahoma Inspection Bureau.
Oregon Insurance Rating Bureau.
Philadelphia Fire Underwriters' Association.
Philadelphia Suburban Underwriters' Association.
Portland Cement Association.
Prepared Roofing Association.
Pyroxylin Plastics Manufacturers' Association.
Railroad Insurance Association.
South-Eastern Underwriters' Association.
St. Louis Fire Prevention Bureau.
Suburban Fire Insurance Exchange.
Tennessee Inspection Bureau.
Terminal Elevator Grain Merchants' Association.
Texas Inspection Bureau.
Texas State Fire Insurance Commission.
Underwriters' Association of the District of Columbia.
Underwriters' Association of the Middle Department.
Underwriters' Bureau of Middle and Southern States.
Underwriters' Bureau of New England.
Underwriters' Laboratories.
Underwriters' Service Association.
Union, The.
United States Fireworks Manufacturers' Association.
Washington Surveying and Rating Bureau.
Western Actuarial Bureau (Fire).
Western Canada Fire Underwriters' Association.
Western Factory Insurance Association.
Western Insurance Bureau.
Western Sprinklered Risk Association.
West Virginia Fire Underwriters' Association.
West Virginia Inspection Bureau.
Wisconsin Inspection Bureau.

PRINTED IN U. S. A.

Table of Contents.

KANSAS CITY THEATRE DISASTER ..... FRONTISPIECE
EDITORIALS 5
COOPERATING FOR EFFECTIVE WORK. *Editorial from* The National Underwriter 9
PICTORIAL COMMENT 10
THE FOUNDATION IS READY. *Editorial from* Fire Protection 12
MEETINGS OF EXECUTIVE COMMITTEE 13
NURSES TAUGHT TO USE EXTINGUISHERS 19
THE 1924 FIRE LOSS 20
HEIGHT LIMITATIONS IN ZONING. *Jacob L. Crane, Jr* 23
DYNAMITE IN FIRE FIGHTING. *H. E. Davis* 29
UNINSULATED STEEL VAULT DOORS. *R. K. Porter* 39
THE YOUNGEST FIRE DEPARTMENT. *G. L. Knotts* 51
EXTINGUISHING ALUMINUM DUST FIRES 53
MUSEUM FIRE PREVENTION. *Edward R. Hardy* 55
A RUBBISH BURNING HAZARD 62
WOODWORKERS; THEIR HAZARDS. *Edmond F. Sisson* 63
CREPE RUBBER SOLES. *Wm. G. Hayne* 72
HAZARDS OF ELECTRIC TRANSFORMERS 74
ANTI-SYPHONING PIPING FOR OIL BURNERS. *B. K. Breed* 78
FOUR-ALARM BUFFALO FIRE. *Report by New York Fire Insurance Rating Organization* 82
NAHANT, MASS., CONFLAGRATION 86

Department of Fire Record.

WELDING PROCESSES—FIRE RECORD 88
LYCEUM THEATRE FIRE, BALTIMORE. *C. V. Gordon* 93
ST. PAUL BRIDGE FIRE. *John Townsend, Jr* 96
FIRES IN WHICH THERE WAS LOSS OF LIFE 97

Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Wide World Photo.

Three persons lost their lives and a number were injured when an explosion and fire which followed wrecked the Gillis Theatre, in Kansas City, Mo., June 25. The explosion, said to have been caused by gas, occurred in a restaurant beneath the theatre.

We extend greetings to the National Fire Protection Association and congratulate them upon the step they have taken to form permanent local fire prevention committees for the purpose of bringing about conditions of greater safety from fire in our various municipalities.

—*National Association of Credit Men,*
Thirtieth Annual Convention, Washington, 1925.

The Quarterly

Vol. 19 **July, 1925** **No. 1**

Twenty-ninth Annual Meeting. For the first time in our history the registration at the Chicago meeting reached the 500 mark,—and there was continuously present during the sessions a larger number of members than ever before. Presumably this heightened interest is due to the rapidly broadening activities of the Association. The general field service and the electrical field service are certain to develop contacts that shall mean a growth in membership and an intensification of interest. Naturally the report of the general field secretary came in for considerable discussion, but not a word of it was unfavorable; in fact, the comments were enthusiastic to a degree. The electrical field work was too new and undeveloped to elicit more than a friendly and interested attention to the report of the electrical field secretary. In Mr. Bugbee and Mr. Canada we believe we have two men in the field whose character and intelligence will reflect credit upon the Association in whatever situation they may encounter. The project of organizing a Fire Commissioners' Section met with general approval and the discussion of this topic was a high light of the meeting. The usual budget of technical reports was disposed of without more than ordinary differences of opinion. The reports of the American and Canadian Joint Fire Prevention Committees were received with the liveliest approval as activities pregnant of future results.

* * * * *

"Smoking-Matches." The most baffling of all the fire causes we have to combat is that of the careless smoker. He has us all at his mercy, and when we consider how he has multiplied in the last decade we wonder that anything that is burnable is left in the world. Ten years ago, United States cigarette production amounted to about 17 billion annually. For the coming year, production is estimated to reach 73 billion by Commissioner of Internal Revenue Blair, who recently stated that this year the tobacco industry would yield more revenue to the government

than all sources of internal revenue prior to 1914, or about $345,000,000. Tobacco taxes amount to $3.12 per capita. The United States leads in the production of cigarettes and the governmental revenue derived from them. It is second only to Belgium in per capita consumption. Over the same ten years, however, cigarette production and consumption has also increased in other countries; in Japan production has grown from 7 to 23 billion, and in Germany from 12 to 23 billion.

Smoking by women has undoubtedly helped to increase the consumption of cigarettes in the United States, but the treatment of cigarette wrappers by nitrates to speed up their burning has done more. This treatment wastes tobacco, increases the revenues of the tobacco companies and the government, and intensifies and multiplies the fire hazards. The habits of our grandparents in chewing tobacco and taking snuff made them personally unattractive, but did not destroy $30,000,000 in property values every year as the smokers are now doing. "An expensive habit," the frugal housewife declares. Expensive indeed. More expensive than she knows!

* * * * *

The Enforcement of Building Codes.

Laws, not enforced, are often worse than no laws at all. America's common method is to enact legislation intended to correct evils or to bring beneficial results, thus satisfying the demand for reform and the public conscience—and then to disregard the law. This is too familiar to require any special comment.

Building codes, if we may judge from the evidence of two recent catastrophes, seem to enjoy little more respect than the prohibition laws. Building codes, however, deserve a different kind of enforcement from that of many other laws commonly violated. Disregard of their provisions entails too serious consequences.

Newspaper readers throughout the country were shocked by the tragedy occurring early in the morning of July 4, when 43 lives were lost in a building collapse. Those killed were revellers in one of Boston's so-called night clubs. The reports state that the building had been undermined by an adjoining cellar excavation, and that the damage caused by a recent fire had not been repaired. Heavy rains, just previous to the disaster, had soaked the interior of the structure; a hole had been cut in the floor of one of the rooms to drain out the water. It was clearly shown that the building was a dilapidated ramshackle fire-trap unfit for any occupancy, much less for use as a place of assembly. Existing legislation provided for the condemnation of such structures and the city authorities had power to act.

On another page of this QUARTERLY is reported an Atlanta fire in which six firemen were killed under somewhat parallel circumstances.

These men, though, were fire fighters, sacrificing their lives in the performance of their duties. The Atlanta building collapse was due to the weight of water-soaked cotton stored on the second floor of a structure weakened by a previous fire and not repaired. This could have been prevented had the building code been enforced.

These two disasters, in different parts of the country and differing in circumstances, point to a common moral: the absolute necessity of building code enforcement. Our attention is constantly directed to the enactment of new and improved codes. Let us also insist upon the proper enforcement of all building codes, new and existing. There is here a field for service of utmost importance.

* * * * *

Electrical Field Service. Our electrical field secretary, Mr. W. J. Canada, who began active work on May 1st, is already deeply immersed in the problems we are looking to him to solve, the character of which was suggested in his remarks at the annual meeting. This being the season of particular activity in revision of local electrical ordinances and the making of new ones,—partly in view of the fact that the new revised edition of the National Electrical Code will soon be available,—a great many of these proposed new ordinance revisions are being submitted for informal review and suggestions to Mr. Canada.

For new ordinances it usually proves practicable to adopt the National Electrical Code, the present American Standard, and otherwise confine the ordinance to administrative features, leaving any special rulings to be cared for, as Inspection Department requirements, as may be provided for under the ordinance. By keeping these special rulings separate from the ordinance they are much less formal and more readily subject to revision or termination. Where it is a question of revising old ordinances and these old ordinances contain more or less numerous interpretations, extensions or changes from the Code itself, or where the Code is incorporated in full text (sometimes together with interpretations, extension and changes) it is very often impracticable to remove all the detailed rules—either of the Code itself or in the way of changes from the Code—from these old ordinances. Often, however, some steps at least in this direction are practicable and make for that greater national uniformity in rules, which local administrators find so desirable from their own administrative standpoint as well as from the economic standpoint of all interests concerned with the application of the local ordinances. In some of the recent ordinances governing electrical wiring, the substance is being confined wholly to administrative provisions and to the adoption of the National Electrical Code as a standard, except that in some instances

the number of types of wiring permissible in certain fire limits (or preferably according to certain classes of buildings) has been more closely restricted than in the Code, with the intent of securing greater simplicity and safety by use of fewer types.

In North Carolina, as an excellent example of state activity in Code and ordinance matters, there has been observed a tendency in electrical ordinances to include such administrative details as making it a misdemeanor for any person to improperly fuse circuits, or to attach improper appliances, or to attach an excessive number of appliances to any electrical circuit. In some cases ordinances prohibit persons from bringing metal pipes nearer than a certain distance from electrical wires, thus placing some of the responsibility for preserving the safety of the electrical installation upon those installing other construction, instead of placing this responsibility wholly upon those installing the electrical work. It is probably in the way of administrative completeness and adequacy that electrical ordinances will, in the future, show their best development. In North Carolina, the State Insurance Department has actively and successfully concerned itself with this phase of the electrical ordinance problem.

* * * * *

The Partitioned Mind.

In a Pullman smoking room the other day a cynical citizen started a lively discussion by asserting that in America the political life is completely alienated from the intellectual life of the country: that the two function quite separately, and that the American thinker or artist regards governmental performances with amused indifference or aloof indignation.

Our present American literature is undoubtedly one of cultural and moral revolt. Books and plays and poems, often homespun in texture and faltering in technique, rarely brilliant or eloquent or scrupulously wrought, have a common aim: their authors burn with a common ardor —to break up the mechanical, imitative mass-life, to liberate the individual, to urge American men and women to live by their taste and their intelligence, not by their prejudices and their tribal passions.

The fact is, however, that intelligence is always in revolt against the accepted beliefs of the mass-mind. American writers at this time are simply making a little more noise about it than usual. A much more curious sort of psychology, however, is what we might call the "partitioned" mind, ideas existing in the same brain but having no speaking acquaintance.

The general manager of a Chamber of Commerce in a city which has a scandalous fire record and potential hazards that may result any day in a general conflagration, stared rather uncomprehendingly when he was recently told that the Chamber's appropriation of $25,000, to be spent at

the rate of $5,000 annually to induce new industries to locate in the city, was a bait for the unwary. He could see no ethical inconsistency in painting local advantages in glowing colors and remaining silent on such a vital matter as public safety. He had no intention of inveigling factories into coming to a place in which at any hour of the day or night their production might be seriously crippled or utterly destroyed by hazards they could not control; he merely had the habit of partitioning his ideas into compartments and calling forth for use only those capable of serving his immediate purpose. He was selling gold bricks for what he thought was a public good.

Co-operating for Effective Work.

Some very significant events are occurring in the life of the National Fire Protection Association at this time. During most of its 29 years of existence, the association has confined itself to the preparation and dissemination of fire safety standards. Now the association is branching out in its efforts and tackling the fire waste problem in individual communities. One of the first steps was the decision to place a secretary in the field. This decision was made last year. Since that time, more than 61 cities have been visited by Secretary F. H. Wentworth and Field Secretary Percy Bugbee. The results have been more than satisfactory. They have been effective beyond the fondest hopes of those who believe the association should undertake work of this kind.

Now the association is arranging for the organization of a separate section for the fire commissioners of American municipalities. The meaning of this action is clear. A uniting of the forces of the National Fire Protection Association and the policy directing heads of the American fire departments means a linking of those who have worked out plans and methods with those who are in position to carry out those plans and methods.

In undertaking these new movements, the National Fire Protection Association is feeling its way. It is going about the work carefully and cautiously. In spite of the most careful planning and operating, dealing directly with local situations, some of them inexpressively bad, is sure to involve some battles and some mistakes. But the association is proceeding along the only path which will make it a vital force in combating the fire waste in local communities.

Acknowledgment was made by Field Secretary Bugbee in the convention in Chicago of the splendid assistance which had been given by local citizens including representatives of the fire insurance business. The association deserves and its cause merits this support.

Editorial, *The National Underwriter, June 4, 1925.*

"A GENERAL ALARM"

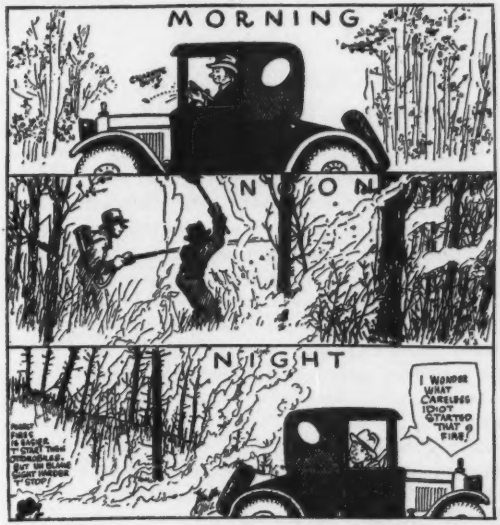
Carrel
in the
New York
Evening World.

SCHOOL DAYS (Copyrighted) By DWIG

GIMME A COUPLE O PUFFS- NOW IT'S MY TURN
FIRE
OF COURSE IF YOU'VE NEVER SMOKED THE HIRED MAN'S PIPE IN THE HAYMOW WITHOUT SETTIN' THE BARN ON FIRE YOU CAN'T BE EXPECTED TO SWALLOW A GUARDIAN ANGEL

Dwiggins
in the
Boston
Traveler.

THE BURNING QUESTION OF MOTORISTS :: By Collier



Collier in the Boston *Herald.*

How to Beat Old Age :-: By T. E. Powers

Powers in the Chicago *Evening American.*

The Foundation Is Ready.

The National Fire Protection Association held its 29th annual meeting last month. Looking back over the history of 29 years, it is seen that a vast amount of constructive work has been done. Yet, looking into the future, the challenge that presents itself to the association and new plans now under way, the past appeals chiefly as a foundation upon which is to be placed a noble structure of results. The analogy is particularly apt because the work of the association in the past has not been done in the public eye, it has not been such as to bring it into intimate contact with large community groups, it has not taken itself aggressively to the people. The people could not see the splendid foundation which has been laid but they will see what is to be built upon this foundation because that work is to show where all can see it.

The making of standards, the linking together of a small but cohesive national group interested in fire safety, the harmonizing of conflicting trade interests—these have all been preliminary to the work now being undertaken through the field secretary and through the plans to establish a fire commissioners' section. The procedure is entirely logical. The association representative can go into the local community and say, "We have brought together the national forces interested in this subject of fire safety, we have united them behind these standards of practice and operation and now we come into the local community to do the same work there, to harmonize local interests in favor of definite, constructive action in making our national standards live in community practice."

Next to the adoption last year of the field secretary plan, nothing is so promising of tangible results for fire prevention as the proposed fire commissioners' section of the National Fire Protection Association. It is the fire commissioner, the director of public safety or the civilian in control of the fire department, whatever his title may be, who usually has a deciding voice in determining the policies which the municipal government will carry out for promoting fire safety.

The plan for a fire commissioners' section is a direct outgrowth of the field secretary's work. Other constructive plans are sure to evolve as the result of closer contact with the people and with community problems of fire protection and prevention. Direct contact with a problem at its final point of solution always develops the most practical plans for solving the problem. That is a principal reason why the field secretary plan will make the association a much more powerful factor than it has been heretofore.

—Editorial in *Fire Protection.*

Meetings of Executive Committee.

May 11, 1925.

The usual session of the executives the night before the annual meeting was held at Chicago on the evening of May 11, 1925.

The following members were present:

Albert T. Bell, Atlantic City, Chairman
J. I. Banash, Chicago
Geo. W. Booth, New York
W. S. Boyd, Chicago
Geo. W. Elliott, Philadelphia
Clarence Heller, San Francisco
Frank C. Jordan, Indianapolis
S. D. McComb, New York
C. L. Scofield, Montreal
W. F. Steffens, New York
H. V. Thayer, Boston
Louis Wiederhold, Jr., Philadelphia
Rudolph P. Miller, New York, President
Dana Pierce, Chicago, Vice-President
Allen M. Schoen, Atlanta, Vice-President
H. O. Lacount, Boston, Past President
Franklin H. Wentworth, Boston, Secretary-Treasurer.

Business Transacted.

The report of the chairman to the annual meeting was approved.

The report of the treasurer was approved.

The report of the Special Conference Committee on spacings between oil tanks and adjacent property was received and the committee discharged, this matter and all data in connection therewith being referred to the Committee on Flammable Liquids for consideration and report to the Association at its next meeting.

Plans outlined by the chairman for financing the Association's field service were discussed and approved.

The employment of W. J. Canada as electrical field secretary, beginning May 1st, was approved.

A Committee on Electrical Field Service was created with the following personnel:—

A. R. Small (Chairman, Electrical Committee), Chairman
W. H. Blood, Boston, representing National Electric Light Association
Geo. W. Booth, New York, representing National Board of Fire Underwriters
T. J. Creaghead, Cincinnati, representing Electrical Supply Jobbers' Association
A. Penn Denton, Kansas City, representing Association of Electragists
S. L. Nicholson, New York, representing Electrical Manufacturers' Council
Dana Pierce, Chicago, representing Underwriters' Laboratories, Inc.
Franklin H. Wentworth, Boston, Secretary N. F. P. A. (Ex Officio).

The Foundation Is Ready.

The National Fire Protection Association held its 29th annual meeting last month. Looking back over the history of 29 years, it is seen that a vast amount of constructive work has been done. Yet, looking into the future, the challenge that presents itself to the association and new plans now under way, the past appeals chiefly as a foundation upon which is to be placed a noble structure of results. The analogy is particularly apt because the work of the association in the past has not been done in the public eye, it has not been such as to bring it into intimate contact with large community groups, it has not taken itself aggressively to the people. The people could not see the splendid foundation which has been laid but they will see what is to be built upon this foundation because that work is to show where all can see it.

The making of standards, the linking together of a small but cohesive national group interested in fire safety, the harmonizing of conflicting trade interests—these have all been preliminary to the work now being undertaken through the field secretary and through the plans to establish a fire commissioners' section. The procedure is entirely logical. The association representative can go into the local community and say, "We have brought together the national forces interested in this subject of fire safety, we have united them behind these standards of practice and operation and now we come into the local community to do the same work there, to harmonize local interests in favor of definite, constructive action in making our national standards live in community practice."

Next to the adoption last year of the field secretary plan, nothing is so promising of tangible results for fire prevention as the proposed fire commissioners' section of the National Fire Protection Association. It is the fire commissioner, the director of public safety or the civilian in control of the fire department, whatever his title may be, who usually has a deciding voice in determining the policies which the municipal government will carry out for promoting fire safety.

The plan for a fire commissioners' section is a direct outgrowth of the field secretary's work. Other constructive plans are sure to evolve as the result of closer contact with the people and with community problems of fire protection and prevention. Direct contact with a problem at its final point of solution always develops the most practical plans for solving the problem. That is a principal reason why the field secretary plan will make the association a much more powerful factor than it has been heretofore.

—Editorial in *Fire Protection.*

Meetings of Executive Committee.

May 11, 1925.

The usual session of the executives the night before the annual meeting was held at Chicago on the evening of May 11, 1925.

The following members were present:

Albert T. Bell, Atlantic City, Chairman
J. I. Banash, Chicago
Geo. W. Booth, New York
W. S. Boyd, Chicago
Geo. W. Elliott, Philadelphia
Clarence Heller, San Francisco
Frank C. Jordan, Indianapolis
S. D. McComb, New York
C. L. Scofield, Montreal
W. F. Steffens, New York
H. V. Thayer, Boston
Louis Wiederhold, Jr., Philadelphia
Rudolph P. Miller, New York, President
Dana Pierce, Chicago, Vice-President
Allen M. Schoen, Atlanta, Vice-President
H. O. Lacount, Boston, Past President
Franklin H. Wentworth, Boston, Secretary-Treasurer.

Business Transacted.

The report of the chairman to the annual meeting was approved.

The report of the treasurer was approved.

The report of the Special Conference Committee on spacings between oil tanks and adjacent property was received and the committee discharged, this matter and all data in connection therewith being referred to the Committee on Flammable Liquids for consideration and report to the Association at its next meeting.

Plans outlined by the chairman for financing the Association's field service were discussed and approved.

The employment of W. J. Canada as electrical field secretary, beginning May 1st, was approved.

A Committee on Electrical Field Service was created with the following personnel:—

A. R. Small (Chairman, Electrical Committee), Chairman
W. H. Blood, Boston, representing National Electric Light Association
Geo. W. Booth, New York, representing National Board of Fire Underwriters
T. J. Creaghead, Cincinnati, representing Electrical Supply Jobbers' Association
A. Penn Denton, Kansas City, representing Association of Electragists
S. L. Nicholson, New York, representing Electrical Manufacturers' Council
Dana Pierce, Chicago, representing Underwriters' Laboratories, Inc.
Franklin H. Wentworth, Boston, Secretary N. F. P. A. (Ex Officio).

The appointment by the president of Mr. S. D. McComb to represent the N. F. P. A. as an advisory member of the Executive Board of the American Marine Standards Committee was confirmed.

The following changes in committee rosters were approved:

Blower Systems. Mr. J. A. Neale appointed to replace Mr. A. H. Barry.

Electrical. Revision of personnel to insure official recognition as a Sectional Committee of the American Engineering Standards Committee. (1925 Year Book will show complete list.)

Electric Railway Car Houses and Cars. Mr. R. S. Beers and Mr. G. M. Woods appointed as representatives of Electric Power Club.

Gases. Mr. J. A. Neale appointed to replace Mr. A. H. Barry as representative of Chicago Board of Fire Underwriters.

Manufacturing Risks and Special Hazards. Mr. J. G. Hubbell (Chicago) was appointed chairman in place of Mr. W. D. Milne (Boston), resigned.

Marine. (a) Mr. A. R. Small (New York) was appointed a member and designated on request of Chairman S. D. McComb as the second representative of the N. F. P. A. on the Sectional Committee (A.E.S.C.) on Standards for Electrical Installations on Shipboard. (b) Mr. J. A. Kelley was appointed as representative of New York and New Jersey Dry Dock Association.

Protection of Records. Mr. J. H. Bissell appointed to replace Mr. W. F. Stevens as representative of National Electric Light Association. Mr. Leroy E. Kern appointed as representative of American Institute of Architects.

June 22, 1925.

MEMBERS PRESENT.

Albert T. Bell, Atlantic City, Chairman
George W. Booth, New York
H. L. Miner, Wilmington
F. T. Moses, Providence
S. D. McComb, New York
W. W. Orr, New York
C. L. Scofield, Montreal
W. F. Steffens, New York
Paul W. Terry, St. Louis
Louis Wiederhold, Jr., Philadelphia
Rudolph P. Miller, New York, President
Dana Pierce, Chicago, Vice-President
A. M. Schoen, Atlanta, Vice-President
H. O. Lacount, Boston, Past President
W. E. Mallalieu, New York, Past President
Franklin H. Wentworth, Boston, Secretary-Treasurer.

GUEST PRESENT.

Mr. Hickman Price, New York.

Business Transacted.

It was voted to hold the thirtieth annual meeting in Atlantic City, May 11, 12, 13, 1926. The president, the secretary and the chairman of the Executive Committee were appointed as the Program Committee.

The plan of assigning definite periods to the consideration of items on the program of annual meetings was discussed and referred to the Program Committee for favorable consideration.

Messrs. W. W. Orr and H. L. Miner were appointed to complete the Nominating Committee, 1926.

ITEMS FROM ANNUAL MEETING:

(a) *Building Construction Committee.*

A proposed amendment to requirements for roof coverings in the regulations for private residences—Grade C was referred to the Secretary, N. F. P. A., and the late chairman of the Committee with power.

(b) *Electrical Committee.*

The following amendments to the National Electrical Code, edition of 1925, recommended by the Electrical Committee as corrections of editorial and compilation oversights were approved:

Section 613-a. The first sentence of this rule is to be amended by inserting the phrase "except in storage battery rooms, may be" between the words "or" and "placed" in the third line. (Refer to 1923 edition.) This change is made to avoid conflict with new paragraph 1802-b.

Section 1302-f. To make consistent with 807-d and f. The text is to be revised to read: "In wiring switchboards, the ground detector, voltmeter, pilot lights and potential transformers shall be connected to a circuit that is protected by 15 ampere fuses." (Refer to 1923 edition.)

Section 1402-e. The phrase "unless type S cord is used" is to be added to the present rule. (Refer to 1923 edition.) This amendment or addition is necessary to avoid a conflict with the change made by the Committee at the February Meeting. See last paragraph of 603-c, preprint of Committee's report, 1925.

(c) *Flammable Liquids Committee.*

On recommendation of the Committee the following amendments to the regulations indicated were approved:

1. **Domestic Fuel Oil Regulations.** Amend Section 3-c to read as follows: *"All vent pipes shall be of ample size to prevent abnormal pressure in case of fire or when filling in no case to be less than 1 inch pipe size; such* vent pipes shall have the lower end extend through the top into the tank for a distance of not more than 1 inch. Outer ends of vent pipes shall be provided with weather-proof hood screened to prevent obstruction by insects, and terminating at a point outside of building, preferably not less than 3 feet measured horizontally or vertically from any window or other building opening."

2. **Regulations for Dry Cleaning and Dry Dyeing Plants.** (Italics indicate changes or additions.)

Definitions.

1. (d) (Amend to read:) *"Brushing"* or *"scouring"* with flammable solutions.

3. (New paragraph.) Flammable liquid shall be defined as any liquid which, under operation conditions, gives off vapor which when properly mixed with air is combustible and explosive.

Section 1. General Requirements.

11. (Amend to read:) *Except as provided in par. 93 (a)*, dry cleaning by immersion and agitation in open vessels is prohibited.

Section 4. Construction of Buildings.

42. (Omit "if used" in fifth sentence. Omit seventh sentence. Omit NOTE following.)

43. (Omit "non-abrasive" in last sentence.)

46. (New paragraph.) Drying rooms if under the same roof as the dry cleaning and dry dyeing rooms shall be separated from such rooms by a fire-resistive wall. The entrance to such drying room or rooms shall be provided with standard self-closing fire doors. Ventilation of such drying rooms shall conform to the requirements for ventilation of dry cleaning and dry dyeing buildings, and the provisions for the presence of steam jets for fire extinguishment shall be complied with. If the drying room is in a separate building, it shall conform in construction and equipment to all requirements for dry cleaning and dry dyeing buildings.

Section 5. Ventilation, Lighting, Heating.

51. (Amend to read:) A mechanical system of ventilation shall be installed in accordance with the regulations governing Blower Systems *and shall be provided with means for remote control.* (Second paragraph not changed.)

53. (Omit this paragraph.)

Renumber paragraph 54 as 53, 55 as 54, and 56 as 55.

Section 7. Tanks, Purifiers, Clarifiers.

72. (f) (Omit this paragraph. Revised, its substance is covered in 106 (b).)

73. (e) (Insert "piston", between "the" and "rotary".)

Section 8. Pumps, Etc.

82. (b) (Omit this paragraph. Reletter sub-paragraph (c) as (d), (d) as (c), and (e) as (d). Insert former paragraph 85 (e) as sub-paragraph 82 (e).)

83. (b) (Amend to read:) Each still shall be equipped with a vacuum and pressure relief valve arranged to discharge outside of the building. Relief valves shall be not less than 1½ inches, set at not over five pounds, *and, when shut-off valve is installed between still and condenser, shall be located on still side of shut-off valve. A check valve shall be installed in the steam line between the boiler and the still.*

83. (d) (Omit this paragraph. Substance covered by 106 (b).)

84. (c) (Change "¾" to "⅜".)

84. (e) (Omit the last sentence.)

85. (e) (This becomes paragraph 82 (e). Sub-paragraph (f) relettered as (e), and (g) as (f).)

Section 9. Scouring *or Brushing, and* Spotting.

91. (Amend to read:) All *scouring* or *brushing* operations shall be carried on in the dry cleaning room or in a separate fire-resistive compartment with wall openings to the outside only, except that where vacuum systems are installed, scouring *or brushing* operations shall be carried on in a ventilated dry cleaning room, or in a separate fire-resistive room *conforming to all the requirements for dry cleaning rooms.*

92. (Amend to read:) The scouring *or brushing* table shall have a liquid tight top with a curb on all sides not less than one inch high. The top of the table shall be so pitched as to ensure thorough drainage to a 1½ inch drain connection with liquid seal trap direct to underground tank. Metal tops *where used* shall be *liquid* tight, and permanently and effectively grounded. The table shall be secured to the floor or wall so as not to disturb the ground and drain connections.

93 (*a*) The scouring *or brushing* table *or scrubbing tub* shall be so located as to ensure thorough and effective disposal of vapors through the ventilating system.

(b) (This is a new sub-paragraph replacing the one formerly lettered (a):) Articles, the character of which prevents their washing in the usual washing machines may be cleaned on scouring or brushing tables or in approved scrubbing tubs provided the total amount of solvent used in such open containers shall not exceed 3 gallons. Solvents for this purpose shall be stored in approved safety

cans and returned to setting tanks as soon as the operation is completed. Scrubbing tubs shall be secured to the floor and shall be provided with permanent 1½ inch trapped drains to underground tanks.

94. (New paragraph.) Flammable solvents used in connection with spotting operations shall be limited to one quart and shall be stored in and applied from an approved safety can.

Section 10. Operating Requirements.

106. (Amend as follows:) (*a*) The lint and refuse shall be removed from all traps after the close of the day's work, deposited in approved waste cans, removed from the premises and *safely disposed of.* At all other times the trap covers shall be kept securely in place.

(*b*) *All above ground containers such as washing machines, tanks, purifiers, clarifiers, stills and condensers shall be drained of all solvents immediately after the close of each day.*

107. (Reletter (a), and omit words "all machines and".)

(b) (New sub-paragraph.) In order that reliable operation of the steam or other extinguishing system may be ensured, periodic inspections of all valves and piping shall be made. Steam lines shall also be subjected to test.

108. (New paragraph.) Sludge deposits formed in treating tanks, stills or any other receptacles shall be free from volatile flammable liquids before being drawn from their containers.

109. (New paragraph.) No drying operation before washing shall be permitted unless articles so dried are properly humidified before removal to washing machines.

Section 11. Fire Protection.

113. (Replace with the following:) Each dry dyeing room, dry cleaning room, and drying room shall be equipped with a steam supply pipe or pipes, directly from boiler or main supply line for the purpose of extinguishing fires. Such steam supply pipe or pipes shall be of sufficient capacity to completely fill the room or spaces in such room or rooms in less than one minute. The discharge orifices for the steam line shall be not less than ¾ inch in diameter, with pipe sizes and piping in accordance with the regulations for automatic sprinkler equipment. Steam jets shall be installed in an upright position. The pipes shall be provided with a globe valve or an outside screw and yoke valve installed on the steam service line or lines outside of the dry dyeing room, dry cleaning room or dry room or rooms in an accessible place for operation in case of fire. An adequate steam supply for extinguishing purposes shall be continually available while the plant is in operation and all valves and piping comprising the steam extinguishing system shall be maintained in proper operative condition.

An equally efficient approved fire extinguishing system employing a fire retardant chemical or gas may be substituted for the steam extinguishing system, provided, however, that the portable equipment required in par. 112 shall in no case be considered as a substitute for a steam extinguishing system.

Before any installation is made the inspection department having jurisdiction shall be consulted.

Section 12. Air Conditioning.

122. (Change "45 per cent" to "60 per cent".)

The matter of routine procedure of the Nominating Committee was discussed and referred to the Secretary.

It was voted to request all representatives of the N. F. P. A. serving upon Sectional Committees of the American Engineering Standards Committee to report annually to the Association the progress and status of the projects under consideration by such Sectional Committees.

The matter of submitting N. F. P. A. regulations on Dust Explosion Hazards to the American Engineering Standards Committee for registra-

tion as American Standards was referred to the Secretary for consideration and report to the Executive Committee.

The Finance Committee reported progress in plans for financing N. F. P. A. field service.

The budget 1925-1926 presented by the treasurer was approved.

A plan presented by Mr. Hickman Price for intensive fire protection education through the medium of the newspapers was discussed without action.

Mr. C. W. Mowry, chairman, Committee on Hydrants, Valves and Pipe Fittings, was appointed representative of the N. F. P. A. on a Sectional Committee of the American Engineering Standards Committee on Cast Iron Pipe, for which project the following organizations are sponsors: American Water Works Association, New England Water Works Association, American Gas Association, American Society for Testing Materials.

A communication from member G. E. Stecher recommending a special form of N. F. P. A. publication was referred to the secretary.

The following Committees were abolished:

(a) Electric Railway Car Houses and Cars
(b) Fire Department Co-operation.

New Committees were created as follows:

(a) Electric Railway Power Houses.
(b) Pyrotechnics.

A Fire Commissioners' Section was created.

The secretary was authorized to confer with our member the National Automatic Sprinkler Association and the chairman of the Committee on Automatic Sprinklers respecting the addition of two representatives of the sprinkler industry on that Committee.

The membership of the Association's committees was reviewed and the changes in the same with the personnel of the new committees and the Fire Commissioners' Section will appear in the forthcoming Year Book.

Nurses Taught to Use Extinguishers.

At the Lynn, Massachusetts, Hospital, the nursing staff is given instruction in the use and handling of the first aid fire equipment as a part of their regular duties. Drills are held at frequent intervals, and the instruction is made a part of the various courses of training at the nurses' training schools. Firemen of the city department also assist materially during the instruction period, giving short lectures on the use of the first aid equipment.

Extinguishers are recharged at a nearby fire station once each month. Advantage is taken of this practice and the nurses are given an opportunity to actually operate the extinguishers when they are discharged preparatory to recharging. The accompanying photograph shows them practising on a bonfire especially built for the purpose. These drills are usually held under the direction of Chief Edward E. Chase of the Lynn Fire Department and are considered of considerable importance because the nurses are given not only a knowledge of how the first aid fire equipment operates, but confidence in their ability to use it effectively on an actual fire.

The nurses make up a private fire brigade under the direction of a chief and deputy chosen from their own number. The chief and deputy make frequent inspection of the apparatus and are responsible for seeing that the chemicals, hose reels, fire buckets and other equipment are properly maintained.

The 1924 Fire Loss.

The total U. S. fire loss for 1924 was $548,810,000, according to the estimates of the Actuarial Bureau of the National Board of Fire Underwriters (Member N. F. P. A.) as presented in the current report of their Committee on Statistics and Origin of Fires. The per capita fire loss for the entire country is set at $4.90. For 366 cities the average per capita loss is $3.37.

A list of the cities in which the losses in 1924 and 1923 exceeded $5.00 per capita follows. Figures for 1917-1921 appeared in the July, 1922, QUARTERLY (Vol. 16, No. 1, p. 16) and figures for 1922 appeared in the July, 1923, QUARTERLY (Vol. 17, No. 1, p. 26).

CITIES IN WHICH LOSS EXCEEDED $5.00 PER CAPITA.

1924

‡Pine Bluff, Ark.	$47.62	*Lynchburg, Va.	$7.92
Kearney, N. J.	41.40	**Dallas, Tex.	7.88
White Plains, N. Y.	21.61	E. Providence, R. I.	7.60
Bellingham, Wash.	20.88	Fort Wayne, Ind.	7.58
Waukegan, Ill.	17.85	†Shreveport, La.	7.44
*Logansport, Ind.	15.54	Wheeling, W. Va.	7.37
†Marion, Ind.	15.21	‡Wichita Falls, Tex.	7.27
Leavenworth, Kans.	13.62	Cambridge, Mass.	7.15
*Bay City, Mich.	12.46	**Kansas City, Mo.	6.95
Boise, Idaho	11.99	*Grand Rapids, Mich.	6.90
Lynn, Mass.	11.71	*Niagara Falls, N. Y.	6.66
Williamsport, Pa.	11.14	†Macon, Ga.	6.54
†Kokomo, Ind.	11.20	Lawrence, Mass.	6.52
*Vicksburg, Miss.	10.85	‡Charlotte, N. C.	6.44
‡Springfield, Ill.	10.78	**Chelsea, Mass.	6.24
†Wilmington, N. C.	10.74	†Beverly, Mass.	6.25
Parkersburg, W. Va.	10.42	†Boston, Mass.	6.19
*Little Rock, Ark.	10.24	*Riverside, Cal.	6.19
‡Meridian, Miss.	10.03	*Sacramento, Cal.	6.10
Huntington, W. Va.	9.91	*Troy, N. Y.	5.85
Evansville, Ind.	9.88	†Pontiac, Mich.	5.79
Oil City, Pa.	9.86	West New York, N. J.	5.71
New Bedford, Mass.	9.72	†Jackson, Miss.	5.69
†Fort Worth, Tex.	9.54	Ashtabula, O.	5.56
†Gloversville, N. Y.	9.04	†Des Moines, Iowa	5.50
*Springfield, Mo.	9.02	†Alton, Ill.	5.47
*Jamestown, N. Y.	8.81	†Fort Dodge, Iowa	5.45
Cicero, Ill.	8.80	*New Haven, Conn.	5.43
Lowell, Mass.	8.66	*Sioux Falls, Iowa	5.42
‡Garfield, N. J.	8.60	Dunkirk, N. Y.	5.27
*Peabody, Mass.	8.56	Spokane, Wash.	5.26
Peoria, Ill.	8.43	Jersey City, N. J.	5.15
Atlantic City, N. J.	8.18	*Gloucester, Mass.	5.07
Saginaw, Mich.	8.13	**Haverhill, Mass.	5.03
†Moline, Ill.	8.13	*Buffalo, N. Y.	5.01
*Asheville, N. C.	8.09		

Cities in which Loss Exceeded $5.00 Per Capita.

1923

Chicago Heights, Ill.	$28.95	Wichita, Kans.	$6.77
†Jackson, Miss.	27.83	*Durham, N. C.	6.73
Hagerstown, Md.	18.33	Key West, Fla.	6.72
*Montgomery, Ala.	15.03	Louisville, Ky.	6.69
‡Charlotte, N. C.	14.81	†Nashville, Tenn.	6.55
Muskegon, Mich.	13.31	*Savannah, Ga.	6.52
†Marion, Ind.	13.00	Duluth, Minn.	6.52
‡Garfield, N. J.	12.63	‡Pine Bluff, Ark.	6.47
Omaha, Nebr.	11.43	*Vicksburg, Miss.	6.46
‡Concord, N. H.	11.14	‡Springfield, Ill.	6.21
Plainfield, N. J.	10.82	Norwalk, Conn.	6.20
**Chelsea, Mass.	10.61	*Springfield, Mass.	6.14
*Stockton, Cal.	10.55	Burlington, Iowa	6.13
†Charleston, W. Va.	10.52	†Shreveport, La.	6.08
**Dallas, Tex.	10.06	‡Memphis, Tenn.	6.04
Duquesne, Pa.	10.00	Danville, Ill.	5.92
*Springfield, Mo.	9.85	†Moline, Ill.	5.73
†Oshkosh, Wis.	9.78	Revere, Mass.	5.67
Leominster, Mass.	9.45	Baton Rouge, La.	5.63
*Riverside, Cal.	9.11	*New London, Conn.	5.60
Lancaster, Pa.	8.94	†Ottumwa, Iowa	5.56
**Haverhill, Mass.	8.56	*La Crosse, Wis.	5.51
New Albany, Ind.	8.36	*Sedalia, Mo.	5.48
†Boston, Mass.	8.18	Lowell, Mass.	5.44
†Fort Smith, Ark.	8.05	†Battle Creek, Mich.	5.44
*Grand Rapids, Mich.	8.03	†Wilmington, N. C.	5.40
*Eau Claire, Wis.	7.44	*Oswego, N. Y.	5.37
.*Asheville, N. C.	7.22	*Niagara Falls, N. Y.	5.36
Providence, R. I.	7.21	†Kokomo, Ind.	5.34
†Alton, Ill.	7.18	*Lexington, Ky.	5.28
**Kansas City, Mo.	7.18	*Buffalo, N. Y.	5.24
Everett, Mass.	7.14	*Columbus, Ga.	5.14
Ogden, Utah	6.86	†St. Paul, Minn.	5.13
*Winona, Minn.	6.79	Utica, N. Y.	5.01

*These cities in this class in two of the last five years.
†In this class three of the five years.
‡In this class four of the five years.
**In this class five years.

The following cities are those which come in for especial mention because they have had high burning records (over $5 per capita) for five successive years:

Chelsea, Mass.	Haverhill, Mass.
Dallas, Texas.	Kansas City, Mo.

Chelsea is the only city in the United States that has been in this class for the past six consecutive years.

ANNUAL FIRE LOSSES IN THE UNITED STATES FOR FIFTY YEARS—1875-1924 INCLUSIVE

Year	Aggregate Property Loss	Year	Aggregate Property Loss	Year	Aggregate Property Loss
1875	$78,102,285	1892	$151,516,098	1909	$188,705,150
1876	64,630,600	1893	167,544,370	1910	214,003,300
1877	68,265,800	1894	140,006,484	1911	217,004,575
1878	64,315,900	1895	142,110,233	1912	206,438,900
1879	77,703,700	1896	118,737,420	1913	203,763,550
1880	74,643,400	1897	116,354,575	1914	221,439,350
1881	81,280,900	1898	130,593,905	1915	172,033,200
1882	84,505,024	1899	153,597,830	1916	258,377,952
1883	100,149,228	1900	160,929,805	1917	289,535,050
1884	110,008,611	1901	165,817,810	1918	353,878,876
1885	102,818,796	1902	161,078,040	1919	320,540,399
1886	104,924,750	1903	145,302,155	1920	447,886,677
1887	120,283,055	1904	229,198,050	1921	495,406,012
1888	110,885,665	1905	165,221,650	1922	506,541,001
1889	123,046,833	1906	518,611,800	1923	535,372,782
1890	108,993,792	1907	215,084,709	1924	548,810,639
1891	143,764,967	1908	217,885,850		

NOTE:—Previous to 1916 figures obtained from the Records of the *Journal of Commerce*, deducting the Canadian losses. Subsequent years based on returns to Actuarial Bureau Committee of the National Board of Fire Underwriters, adding 25% for unreported and uninsured losses.

The Stratfield Hotel at Bridgeport, Connecticut, has brass plates like the one here illustrated on the sills of all upper windows.

Height Limitations in Zoning.

By Jacob L. Crane, Jr.
City Planning Engineer, Chicago, Ill.

The earliest limitations on building height, as far as the writer has been able to determine, were established in Rome under the Emperors, Augustus and Trajan. The congestion of population in Rome, as in modern cities, made the high tenement house profitable. Acting under the pressure of complaint against the overcrowding, with its fire hazard, Augustus limited the height of all new buildings to 70 ft., and Trajan established a 60-ft. limitation. The need for regulation and the precedent for it are, therefore, not less than 1500 years old.

In modern times, the precedent for height limitation was established in France and Germany, and from there spread to the Swiss, Scandinavian, English, and American cities. In 1882, height regulations were in effect in Paris. In 1891, shortly after he had been employed as Mayor of Frankfort, the famous Franz Adickes introduced a zoning system which incorporated height regulations expressed in terms of the street width.

The London Building Act, which regulates the height of buildings, went into effect in 1894. An unsuccessful attempt was made during 1923 to break down this code and to permit "American building development." The limitations in European cities range from 43 ft. in Zurich to 80 and 82 ft. in London and Vienna, respectively.

In America, the first height limitation was established by the City of Chicago. In 1892, an ordinance was passed setting 150 ft. as the maximum height, but this ordinance was vetoed by the Mayor. During the following year an ordinance went into effect limiting buildings to 130 ft. After being raised to 260 ft., reduced again to 200 ft., and again raised to 260 ft., the Chicago height regulation has finally been incorporated in a comprehensive zoning ordinance (1923) which sets the limit at 264 ft. on the building line, plus additional height with set-back.

Several other American cities established height limits previous to the era of zoning, as follows: Baltimore, Md., 175 ft.; Boston, Mass., 125 ft.; Erie, Pa., 200 ft.; Los Angeles, Calif., 150 ft.; Milwaukee, Wis., 225 ft.; New Orleans, La., 160 ft.; Portland, Ore., 160 ft.; Washington, D. C., 160 ft.; and Minneapolis, Minn., 185 ft.

Reprint of parts of a paper presented at the meeting of the City Planning Division of the American Society of Civil Engineers, Detroit, Mich., October 24, 1924.

In all these larger cities (no less than one hundred in Europe and America), the conditions making height limitations necessary have been much the same. Laws of this kind, limiting the use of private property, have never been enacted easily, and height regulations could not have been passed except with the support of purposes of great public importance. Communities have found it necessary to curb the greed and the disregard for the public interest on the part of property owners. The theory underlying height limitations as important measures for public welfare may be outlined as follows:

(*a*).—Such regulations control the fire hazard, which increases with each additional story, other conditions being the same.

(*b*).—They tend to limit the congestion on the streets and in public conveyances, the congestion which follows the crowding of people and business in buildings served by the streets and public conveyances.

(*c*).—They help to preserve the light and air necessary to healthful life in crowded centers.

(*d*).—They spread business, and consequently values, over a larger area than would be occupied by higher buildings.

(*e*).—They have a favorable effect upon architecture, tending to produce a uniform cornice height along streets.

The advantages of high buildings which have been urged as arguments against height limitations, are:

(*f*).—They bring great numbers of people within a small area and thereby make it possible to go quickly and conveniently from home to workshop, or from office to office, to the end of promoting great efficiency in a city's business.

(*g*).—They make it possible to earn a return on enormous land values, which produce taxes, as do the great buildings themselves.

(*h*).—They are in themselves clean, healthful buildings, particularly for office purposes.

(*i*).—They offer opportunity for monumental treatment as an expression of American life, which can only be expressed by the steel frame skyscraper; and these monuments cannot be simply ornamental towers, they must be big enough to "pay."

Based on the theory just outlined, municipal legislative bodies in America have found it to be sound public policy to establish "reasonable" height limitations under the police power which is vested in the States and delegated by them to the cities and villages. Furthermore, the Courts have sustained such applications of the public power in several conclusive cases. The earliest test case was in Boston, Welch *vs.* Wasey, in which the height limitations were upheld by the highest Court in Massachusetts and, later, by the Supreme Court of the United States. A recent and

perhaps the most conclusive case is that of the Wisconsin Telephone Company *vs.* the State of Wisconsin, in which the Supreme Court of Wisconsin upheld the height regulations of the Milwaukee zoning ordinance. There seems to be no room for doubt that height regulations reasonably applied are legally sound. The problem before the bodies enacting such regulations is to secure the maximum effectiveness within the limitation of reasonableness in any given circumstances.

In this country, height regulations are now usually established as parts of comprehensive zoning plans which regulate the use of private land, the area which may be occupied, and the height to which buildings may be constructed in districts of different classes. The heights permitted by regulations range from the maximum for office buildings in the central business districts, lesser heights for apartment houses, local business and industrial districts, to the least for districts in which only single-family houses, churches, schools, and the like are permitted.

To attain ideal conditions in the building of a city, the allowable height would differ for different kinds of buildings. Furthermore, ideal regulations for height would vary with the different objectives for which they are intended. These ideal height limitations may be compared with the limitations of American zoning ordinances, in order to determine the relative effectiveness of such ordinances and the possibility for improving them within the range of reasonableness.

Fire Hazard.

Taking the objectives of zoning in the order in which they have just been named, the ideal limitation of the height of buildings to control the fire hazard may be first set down. No frame building should be more than 2 or 2½ stories high. To meet this requirement, the building code, which must dovetail with the zoning ordinance for the sake of the effectiveness of both, should establish the character of fire-resistant construction required where buildings more than 2½ stories in height are allowed. The problem of height limitation, therefore, as regards fire hazard, is that of the so-called fire-proof building. How high can fire-resistive buildings be constructed with safety to the occupants?

Authorities stress the apparent impossibility of enforcing the regulation of building construction and interior protection and of securing adequate fire-fighting equipment to cope with a catastrophe in a building more than 10 stories high. If it were possible to secure ideal conditions in every other department, fire-resistive buildings might be allowed to go to any feasible height. Failing these ideal conditions, as practically every building does, it must be concluded that, on the score of fire hazard, it would be necessary to limit buildings to not more than 10 stories, or 125 ft.

Architectural Effect.

The writer is among those who a few years ago favored a flat height limitation because of its tendency to produce a uniform sky line, but who have been converted to the possibilities of a sky line such as that being created in New York by the restrictions of the zoning ordinance height regulations. In districts of lesser heights, the desirability of a fairly uniform height along a street is unquestioned, and height limitations justify themselves for this result alone. In the districts of great height, however, that height limitation seems best, from the architectural standpoint, which permits the greatest height but which tends to produce uniformity in the cornice line of the main body of the buildings and, in turn, makes possible a variety of tower and set-back effects. The ultimate result of this type of regulation is not yet evident, but now no great appeal can be made for a low flat height-limit for architectural reasons.

Among the advantages of high buildings as mentioned previously, cencentration of business on small areas has been discussed. For the point that the high buildings are sanitary and well lighted in themselves it may simply be said that the 8 or 10-story building can be and now usually is as well constructed and equipped as the 30-story building. In the monumental treatment of buildings, unlimited height is advantageous. Height limitations of the type in effect in New York are still more advantageous.

The rock on which nearly every height limitation project has been wrecked is that high buildings earn returns on very high land values. The owners of business property of high value appreciate the arguments for height limitations, but when such limitations threaten to emperil their valuations, they, like all good business men, balk. Consider how well American height limitations meet the ideal requirements (ideal only in the sense that they are the actual human requirements for sound public policy) and then re-examine this critical matter of the return on high priced land.

It has been found that the question of ideal height limits requires much more study in order to reach sound and rational factors for setting the limits in any block or for any street. Can it be safely said, however, that the considerations of fire hazard, street congestion, light and air, and decentralization of crowded centers, tend toward a reasonable maximum limit of 10 stories or, say, a volume of ten times the area of a given lot? The heights allowed by various zoning regulations are as shown in the table on the next page.

These regulations carry various modifications with respect to towers and additional height with set-back, but with these, the largest cities with zoning ordinances in effect, only three—Milwaukee, St. Paul, and Wash-

TABLE.

City	Maximum height district, in feet
Atlanta, Ga.	150
Chicago, Ill.	264
Hoboken, N. J.	185
Milwaukee, Wis.	125
Omaha, Nebr.	175
St. Paul, Minn.	130
Washington, D. C.	110
Akron, Ohio	136
Newark, N. J.	150
St. Louis, Mo.	150
New York, N. Y.	250

ington—have regulations which approach the figure which will realize the purposes for which the regulations are intended.

The force behind the high-building tendency in these regulations is largely that of the owners of property on which such buildings may be constructed. Their demands must be met. Until public ownership of land can be realized, or perhaps some single-tax system (and, in fact, the full success of city planning in general cannot be reached until that time), it is reasonable to expect owners to demand the opportunity for a fair return on the market value of the land.

There are, however, certain factors in this phase of the problem which are often overlooked. One factor of great importance is that with a limit so high as to be virtually no limit, as in Chicago with 264 ft., the opportunity to improve property with very high buildings is less than it would be by a lower limit. For example, the central district in Chicago is now built up to an average height of 8 or 9 stories. Streets and transit facilities are already so badly overtaxed that business is being forced from the Loop area. No arrangement or use of the streets on, above, or below the ground, will make it possible to accommodate successfully an average height of more than 12 stories over the whole area. In other words, the owners of property who are able to improve soon with buildings 20 stories high (the present limit), may succeed in earning a return on the "20-story value" of the land. For every property improved to 20 stories, however, some other property will find the business demand so taken up that it can rent only 4 stories, say, and the value of the land will decline accordingly. A 12-story limit in this district besides achieving important public good in relieving traffic congestion, improving public health, etc., would permit the reaping of the full useful value of the area. This value, however, would go to the pockets of all the property owners, several thousand in this case, instead of into the pockets of only those who are able to improve ahead of the others.

Another factor is the decreasing return on buildings above a certain height, which varies with different conditions. Mr. George C. Nimmons has shown the economic fallacy of the very high building. Due to the area occupied by elevator shafts, supporting members and foundation, the actual rate of return normally declines for buildings of more than 20 stories, and the 20-story building has little advantage over that of 12 stories, and none at all if it cannot all be rented, if it is "overbuilt" to any degree.

Assume that the hope for big reward is so strong in every one of the property owners in the central district that they insist on a height limit greater than the public good would dictate, what can be done to improve height regulations?

The suggestions made seem to be worthy of consideration in this connection and as a conclusion to this paper:

First.—Based on intensive studies in each case, buildings seeking to go above a fixed height, say 10 stories, should be required to arrange for a widening of the street by arcades or by setting the buildings back. If necessary, this may be required to be arranged for a whole block before any building is permitted to exceed the fixed limit, as an arcade along the front of one building alone might not be very useful. This, of course, is not a new idea, but it is offered to tie together the matter of high buildings and wider streets and to place the burden for widening the streets where it belongs, namely, on those who profit most by them.

Second.—Any building seeking to go above the fixed limit of, say, 10 stories, should be positively required to put in the most nearly adequate fire protection and exit appliances that it is possible to devise.

Third.—If the streets and the lower floors of buildings are to be made disease-breeding canyons, other means must be devised for controlling the respiratory diseases, eliminating eye strain and nerve strain, living in an unnatural environment cut off from sunlight and fresh air. It is not likely that these means can be devised, but engineers will be searching for them while more high buildings are being constructed and until the evil results become too serious to endure. Then we will begin tearing down and rebuilding our cities. This will be expensive, but by that time we will know better how to build well for human needs.

Dynamite in Fire Fighting.

By H. E. Davis.
Institute of Makers of Explosives (Member N. F. P. A.).

As it is becoming increasingly frequent for fire departments and property owners to resort to dynamite in fighting large fires, it seems desirable to disseminate reliable information as to the function of dynamite in fire fighting, its advantages and limitations for this purpose, and the proper methods of procedure when it is employed.

In the city fire, dynamite is not used as an extinguisher but as an agent for razing buildings in the path of the flames to prevent the fire from spreading. If the spread of the flames cannot be controlled by water and it becomes advisable to wreck some buildings in order to save property of greater value, dynamite is practically the only means by which this can be done quickly enough to be of any avail.

The chief limitations upon the employment of dynamite for wrecking buildings in the path of a fire lie in the fact that the dynamite may not be quickly available and that it can only be safely and effectively handled by men trained in its use.

However, in large cities there is generally a stock of dynamite for excavating and tunneling stored in contractors' magazines which can be secured in emergency and these contractors usually have in their employ a few men experienced in blasting. It has been suggested that the fire department in cities over a certain size should keep a supply of explosives constantly on hand. This would require a specially constructed magazine and investment in a supply of explosives which are subject to deterioration with age and would have to be replaced from time to time with freshly manufactured material. It would, however, be a measure of preparedness which might prove highly valuable to a city menaced with devastation by fire.

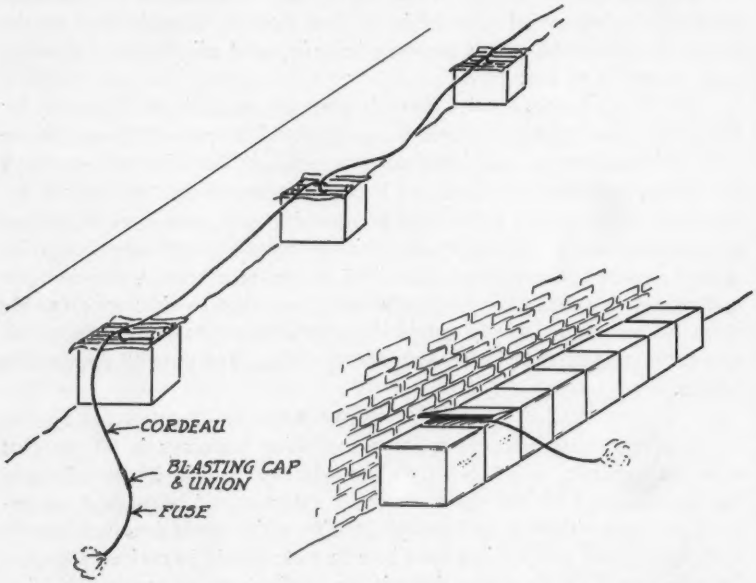
Use Dynamite Only.

The explosive best suited for demolishing buildings is 60 per cent ammonia dynamite in 1¼ x 8 inch cartridges packed in 25 pound cases. As the explosive has the disadvantage in this work of being fired unconfined, an explosive such as blasting gelatin, which gives excellent results when loaded and tamped in a bore hole in rock, would be entirely unsuited for firing in the case where there is no confinement whatever. Neither blasting powder nor railroad powder nor "low powder" (low percentage

of nitro glycerine) should ever be used for this purpose because they are likely to set fire to the building in which they are placed or to throw fire to neighboring buildings. The 25 pound cases are easier to handle than 50 pound cases and also permit distributing the same quantity of dynamite at twice as many points of resistance.

Blasting caps and safety fuse are better for firing the dynamite than electric detonators for several reasons. First, it is not so difficult to take a primer with fuse into a building as it is to take in one with electric blasting cap wires attached to it. In the confusion attending a large fire there is danger that the wires may be cut or pulled off from the electric blasting cap thus spoiling the shot. Second, it takes too long to connect the wires and tape each connection, and if the connections are not properly insulated, there is liability of a short circuit. Third, it is difficult to keep the wires out of the water which is generally on the street and around the building during a fire and this introduces another chance for the current to be short-circuited. Fourth, wires cannot be recovered from under the debris.

If detonating all the charges simultaneously is considered essential to bring down a building, a line of cordeau can be run from one charge to



(Left) Cases of dynamite placed at intervals can be fired simultaneously by the use of cordeau in connection with a blasting cap and fuse. (Right) Several cases of dynamite placed in contact with each other can be fired with blasting cap and fuse.

P. and A. Photo.

Dynamite was used in a sweeping fire in Towanda, N. Y., to clear an area as a barrier to the progress of the fire. The picture was taken just as a blast toppled one of the buildings.

the next, with a wrap around one cartridge in each case of dynamite, and can be fired by a blasting cap and fuse attached to the free end by means of a cordeau coupling.

A blasting cap consists of a small copper tube closed at one end and filled about half full of a very sensitive and violent explosive which is fired by the spark from the end of safety fuse inserted in the cap. When dynamite is ignited unconfined it will usually merely burn quietly but if the blasting cap compound comes in contact with sparks or flame it explodes with great violence. Consequently blasting caps must be guarded very carefully from this source of danger. Safety fuse consists of a powder core, surrounded by several wrappings of hemp and tape with waterproof compound between, the whole being of such a diameter that it fits snugly into the blasting cap. The high grade safety fuse in use in the East burns at the rate of about 30 seconds to the foot. In the West the standard fuses are somewhat slower, burning at the rate of about 40 seconds per foot.

Dynamite, blasting caps and safety fuses all require dry, well ventilated storage, as they tend to deteriorate when exposed to moisture. For reasons of safety, blasting caps should never be stored in the same building with dynamite.

Need for Expert Direction.

If there is a branch office of one of the explosive manufacturers in the city or an explosives plant nearby, at least one or two men can usually be secured who are competent to direct the use of explosives in fire fighting. In order to be sure of having men who know how to use dynamite should the need arise, some fire departments have organized a dynamite squad and are giving these men regular training in the use of explosives. The town of Fresno, California, for example, has a dynamite squad composed of fourteen members of the Rescue Squad Company, four district chiefs, four members of the Fire Prevention Bureau and the Department Drill Master. An explosives expert was secured to conduct the school and the instruction has consisted of lectures and of the actual blasting down of certain structures in Fresno which it was desired to remove. The Chief of the Department feels that by having a trained dynamite squad of more than twenty men, he is almost certain to have in any emergency a number of men who will know how to carry on the work of combating fire with explosives and who will be able to direct intelligently the operations of less experienced men.

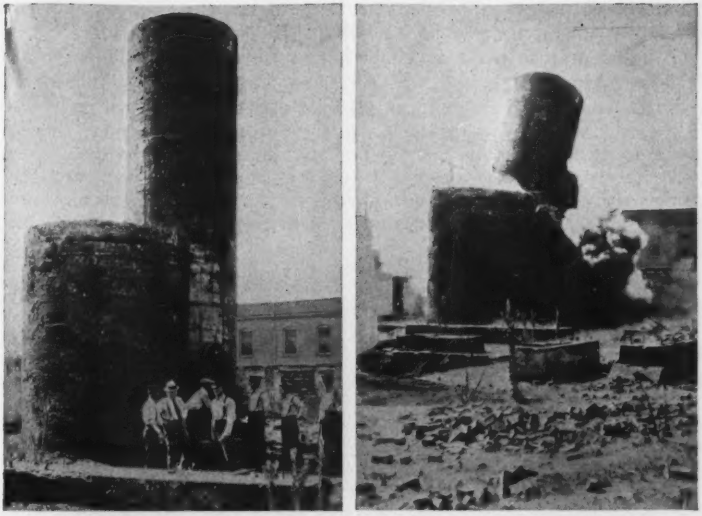
Instructions for Use.

The following instructions for the use of dynamite to check a conflagration are based directly upon the experience of cities where explosives have been tried for this purpose.

1. The explosives should be brought from the base of supplies in a strong covered wagon or truck. This vehicle should be halted at a central spot two or three blocks away from the fire. Light trucks may be used to bring the charges to the buildings to be razed and to remove the men from danger after the fuses are lighted.

2. One man should make primers a short distance away from the powder truck, preparing only the number ordered by the officer in charge. He should be very careful to place the blasting caps and finished primers in a protected place and not leave them lying on the street in the way of the dynamite squad or of vehicles or pedestrians. Making primers consists of attaching a blasting cap to a safety fuse, inserting the blasting cap in a cartridge of dynamite and fastening it there so that it will not pull out.

An inch or two of the end of the fuse should be cut off and discarded, the blasting cap slipped over the end of the fuse and crimped securely in place by means of a special tool called the "cap crimper." This prevents the fuse from slipping out of the blasting cap. The desired length of fuse should then be cut from the coil, three or four feet ordinarily being sufficient to allow the operator to retire to a place of safety after lighting the fuse. Next a hole is punched in the side of the dynamite cartridge, as nearly parallel as possible to the length of the cartridge, the cap is inserted in the hole and a piece of string is tied around the fuse and then



(Left) Members of the dynamite squad of the Fresno Fire Department making ready to fell the taller of the brick stacks shown, as training for the use of explosives in fire fighting. Dimensions of stack, 67 feet high by 9 feet diameter, walls 2½ feet thick. The stack had to be dropped almost in place as damage would be caused should it fall its length in any direction. (Right) The blast—note the absence of flying debris. A preliminary charge was placed in the base for the purpose of weakening it in preparation for the final or dropping charge.

The stack down—mass piled up at the foundation base with no portion extending more than 14¼ feet measured from line of outer walls of the stack. Had it fallen its length to north it would have gone through a brick building the entire front of which was plate glass. This demonstrates the necessity of training experts to handle the explosives.

around the cartridge. The sharpened leg of the cap crimper makes an efficient instrument for punching a hole in the dynamite cartridge.

Another way to make a primer is to punch a hole in the end of the cartridge, insert the cap, and, with a piece of string, tie a slip-knot around the dynamite cartridge, bringing it up tight and tying the other end of the string to the fuse a few inches above the point where it enters the cartridge. Only the blasting cap itself should be in contact with the dynamite. Safety fuse when laced through a cartridge or led through a quantity of dynamite will sometimes emit sparks from the sides and ignite the dynamite before the cap explodes. This results in considerable loss of force.

3. Before any explosive is taken into a building a thorough inspection of the building should be made to make sure that there are no people, either invalids, cripples or others, still remaining in it and also to find out the strength of the building and its relation to others nearby.

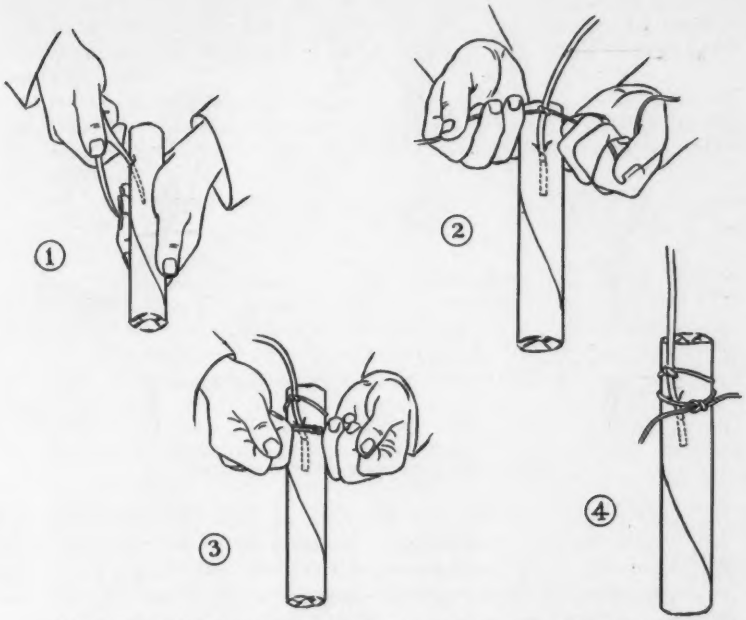
4. The officer in charge should be the judge of the quantity of explosive necessary and of the places where it should be located.

The quantity of dynamite necessary to blow down an ordinary two-story frame dwelling house should not exceed eight 25 pound boxes of 60 per cent extra dynamite. These placed in the center of the basement will usually do the work of destruction perfectly. In brick walls with wooden interiors, it has been found advantageous to string a number of cases close together along the base of the wall. When these are fired the explosion cuts the wall at the base and thus brings down the structure. For two and three-story buildings of this kind from 30 to 40 feet wide, 10 to 15 cases of dynamite should be used. After having destroyed one or more buildings, a man who has had experience in the use of dynamite can readily estimate the quantity which will be required for other buildings. Enough dynamite should be used to avoid incomplete destruction because if the destruction is only partial, it will be dangerous to reenter the building for the purpose of completing the work. It is, however, a common mistake of people not familiar with dynamite to overestimate its power and underestimate the quantity required for any given purpose. A relatively small quantity of dynamite when strictly confined will do a great deal more work than a larger quantity when placed against a wall, on a floor or against a building. In demolishing buildings to check the advance of a fire, it is better to use too large a charge rather than one not large enough.

5. Where buildings are to be destroyed in close, narrow streets, care should be taken that the dynamite is placed as low in the building as is possible in order to prevent a shattering effect on nearby buildings.

6. As a rule, brick buildings should not be destroyed because a standing brick wall is a better protection from fire than it would be in a collapsed heap. It is sometimes necessary, however, to destroy brick structures with wooden interiors because if set afire they would create enough heat to spread the flames to adjoining property.

7. Before firing the charges in any building the gas should be shut off, the electric light wires cut and fires in furnaces or stoves put out.



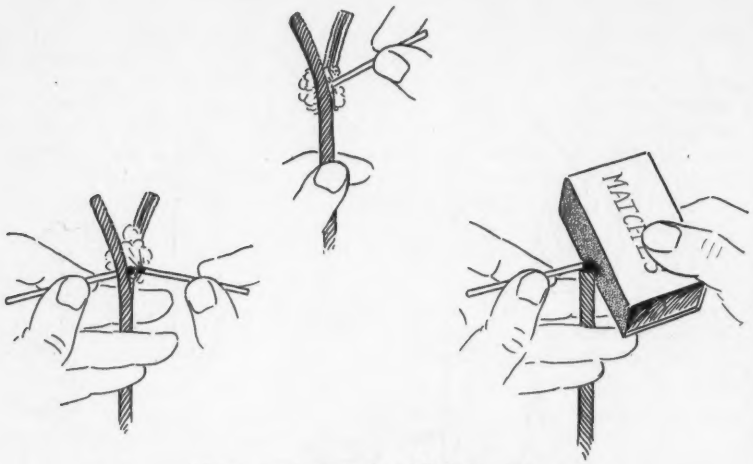
Drawings 1, 2 and 3 illustrate steps in priming a cartridge in the side. Drawing 4 shows the finished primer.

8. If more than one building in a square is to be blown down, the man who is to light the fuse should carry in the explosive, return to the street for the primer and fuse, making sure that he is familiar with the passage way leading from the charge to the street, and await orders to return with the primer.

9. When the charges have all been placed, the man in charge of the primers, who by that time will have finished his work, should drive the light truck to a previously selected central spot on the street and wait to pick up those who light the fuses.

10. At a signal from the officer in charge, each man should enter the house where his charge is located, place the primer in the charge, and light the fuse. One primer with a strong blasting cap is sufficient to explode a number of boxes placed together, provided the cover of one of the boxes is removed and the primer inserted in the box. Each man should be instructed to wait after lighting the fuse until it spits and then to return as quickly as possible to the truck, the driver of this truck telling off the men to the chief as they come out of the houses.

Particular attention must be given to the operation of lighting the fuse. Merely holding a lighted match against the end of the fuse will not ordinarily ignite the powder. A lead spitter fuse lighter provides one of the easiest methods of lighting fuse. This consists of a lead tube ⅛ inch in diameter filled with a powder which burns with a sharp hot flame at



Three good methods of lighting fuse.

the rate of about one foot per thirty-six seconds, the lead melting and falling away as the powder burns. It comes on spools containing about 25 feet. Each man should be given a length sufficient to light the number of fuses for which he is responsible and a pair of pincers with which to hold it.

There are also a number of satisfactory methods of lighting fuse with matches. One is to hold the match head firmly against the end of the fuse and then to strike the safety box against the match. Another is to slit the end of the fuse down to the powder core for a distance of about an inch, lay open the cut so as to expose the powder and place the head of a match, while still flashing, directly into the powder of the fuse; or to place the head of an unlighted match in the slit, strike a second match and hold its flame against the head of the first. In either case it is a good idea to open a dynamite cartridge, take out a little of the powder in the fingers and lay it in the cut end of the fuse before applying the match. Practice in fuse lighting should be a definite part of the training of a dynamite squad to make sure that this operation can be successfully performed in spite of haste and excitement.

While firing with blasting caps and safety fuse is to be preferred to electric blasting for the reasons previously given, in an emergency electric blasting caps can be used, priming the cartridge in the same way as described for blasting caps and fuse. After the primer is placed in the charge, the two ends of the electric blasting cap wires should be connected securely to leading wires, taking care that the two connections are taped or that they cannot touch each other. Such contact can be avoided by making a loop at the end of one blasting cap wire to shorten it so that the two bare joints of the wires will not lie alongside of each other. The leading wires should be connected to a blasting machine at a safe distance from the building to be demolished. This connection is made by insert-

ing the wires in the holes of the two binding posts and screwing the wing nuts down firmly. To fire the blast, the handle of the blasting machine is raised to its full height and forced down with both hands with as much power as possible.

11. At orders from the officer in charge, the truck should drive off out of danger, the officer himself remaining nearby in order to count the shots or to operate the blasting machine and keep people away until after the explosion.

12. The officer in charge should then examine the result of the shot to determine the quantity of dynamite necessary for the buildings in the remainder of the square.

13. When blowing down a whole square, the squad should start on one side and follow the square around, blasting only on one side at a time in order that the officer in charge can see what is going on at all times.

14. If possible the wreckage produced by the blasting should be thoroughly wet down as this will make it a still better barrier to the flames.

Prairie and Forest Fires.

In the case of prairie and forest fires dynamite is used with a double purpose—to make a trench which will block the progress of the fire and to extinguish adjacent flames. To blast a trench four or five feet wide and about two feet deep, holes are put down with a subsoil punch or crowbar about two feet apart and fifteen inches deep. These are loaded with 40 per cent ammonia dynamite primed with electric blasting caps, one cartridge to a hole and fired with a blasting machine. The explosion extinguishes the flames within eight to fifteen feet of the line of holes just as a puff of wind blows out a candle. Earth can then be shovelled from the trench on to the smouldering grass or forest duff to prevent the flames from breaking out again.

To deal with an overhead forest fire, progressing from tree top to tree top, much larger charges will be needed and they should be placed deeper in the ground in order to blast a trench wide enough to prevent the flames from leaping across. Each standing tree should be loaded heavily and brought down, for if left standing they will carry the flames across the trench. In these circumstances the larger the charges the better, provided they are loaded deep enough, for the greater the blast the more easily will the flames be blown out and the more dirt will be thrown over the fire.

The speed with which the holes can be punched, loaded with dynamite and fired makes this a practical method of controlling forest fires, whereas digging a trench by hand takes so long that the fire has opportunity to spread over a large area before it can be checked.

Oil Well Fires.

In a number of instances dynamite has been successfully used to blow out oil well fires after all other means had failed. Here dynamite acts

literally as a fire extinguisher. When a charge is fired in the flaming torch of a gas well, the explosion suddenly liberates an immense volume of rapidly expanding gases in the midst of the blaze. The pressure and velocity of these gases from the explosion is so tremendous that they snuff out the flame below, temporarily stopping the flow of gas from the the well, and blow the blazing gas above so high and wide into the air that there is no flame left to ignite the gas when it starts to pour out of the well again. When dynamite was used several years ago to extinguish a very spectacular oil well fire in the Midway Oil Fields of California where the blaze shot up into the air three hundred feet high, it was reported that the explosive divided the column of fire into three sections. The middle section at the level of the explosion was moved bodily away in a horizontal direction; the upper section was blown upward too high to ignite the gas again; and the lower section was snuffed out entirely. (See QUARTERLY Vol. 14, No. 1, p. 25.)

It would be a mistake for anyone to imagine that dynamite is a universal fire extinguisher, but in the special cases which have been described in this paper, namely city fires where it is desirable to raze buildings to block the progress of the conflagration, prairie and forest fires, and oil well blazes, it has proved, in the hands of careful and experienced men, a valuable adjunct to other means of fire fighting.

FOREST FIRE.

Smoking Cigarettes Leads Two German Girls to Captivity.

Berlin, April 21 (By The Associated Press)—Longing for a smoke while walking recently through the pine woods of Tegeler, near this city, two young girls started a fire that consumed twenty acres of fine timber in two hours.

A lighted cigarette end, carelessly cast aside, ignited the dry pine needles. The girls tried to put out the fire, but could not, and then gave the alarm, but it was too late. They are now in jail, and will be sued for the loss of the forest.

—*Railway Fire Protection Association News Letter.*

Uninsulated Steel Vault Doors.

By R. K. Porter, Engineer.
Underwriters' Laboratories (Member N. F. P. A.).

Openings in vault walls are usually protected by steel doors which may be arbitrarily divided into two general classes, namely, insulated doors and uninsulated doors.

The uninsulated door is at present the most generally used and has demonstrated some efficiency as a fire stop under actual fire conditions, and the investigation covered in the following report was inaugurated with the purpose of ascertaining the performance of a typical door of this kind when subjected to fire exposure.

Description

General Character: The term vault door as used in the following report covers a swinging outer steel door closing against stops, a pair of inner steel doors also closing against stops, the common frame (vestibule) in which they are mounted and the hardware with which they are equipped. The complete device may be considered as a flanged box, the larger faces consisting of doors hinged to the sides.

Frame: The frame or vestibule forms the sides and ends of the box, one end being the top or head, the other the bottom or sill. The flanges overlap the masonry on the sides and top. Detail of the frame is shown in the diagram below.

Doors: The outer door consisted of a ¼-inch steel plate mounted on an angle frame made of 2 x 2 x ¼-inch steel angles. The leg of the angle extending parallel with the door plate to which it was riveted made the door ½ inch thick for a distance of two inches in from the edges.

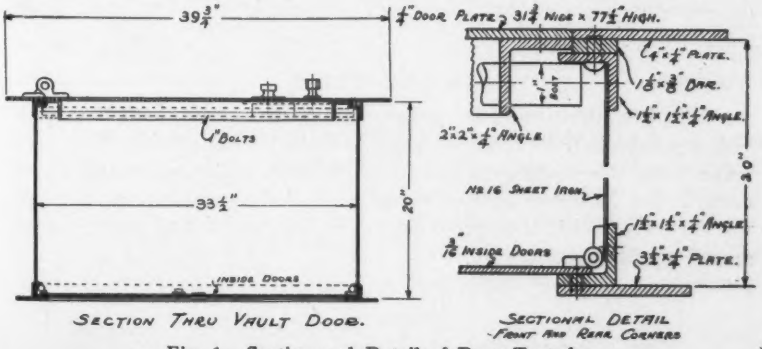


Fig. 1. Section and Detail of Door Tested.

Each of the pair of inner doors consisted of a single sheet of steel 3/16 inch thick. One door of the pair was provided with a steel strip to overlap the space between the doors when shut.

HARDWARE: The outer door was attached to the vestibule frame by two heavy pin hinges made of cast iron.

The outer door was provided with a ten-point locking mechanism consisting of four continuous 1-inch bolts longer than the door was wide and fastened to the common operating bar as shown in photographs; and an upper and lower vertical bolt also made of steel 1 inch in diameter.

A combination locking dial was fastened to the front plate of the door operating a mechanism which threw a bolt against the operating bar preventing movement of the bar and holding the bolts in engagement.

Each door of the pair of inner doors was secured in place by two small pin hinges. Each door was provided with a small metal bar knob and one of these knobs operated a disc latch in such a manner that the turning of the knob caused the latch to engage the other door of the pair. The latch disc mentioned also was fastened to two steel strips extending to the upper and lower ends of the door terminating in flat latch bolts which when in the thrown position overlapped the door frame at top and bottom. The accompanying photographs further explain the installation.

Plan of Investigation

The tests and investigations were primarily designed to ascertain the fire retardant properties of a typical uninsulated steel vault door when properly installed in a vault wall.

It was decided that performance should be demonstrated by subjecting the door to a fire test with temperature gradient conforming to the standard time temperature curve; the door being carefully mounted in a fire-resistive wall with the unexposed side enclosed by a temporary structure simulating a vault, and protection of vault contents being judged to have ceased when a temperature of 300° was recorded at any point in the chamber where combustible substance might be stored or when flame entered the chamber.

Installation Test

The test consisted of the installation of the sample door in a brick wall approximately 11 feet wide and 12 feet high. The portion of the wall immediately surrounding the panel was 20 inches thick over an area measuring 7 feet 10 inches in each dimension and the remainder of the wall was 16 inches thick, thus providing a projection of four inches over an area 7 feet 10 inches square.

Fig. 2. Showing masonry in contact with the unexposed surfaces of the vestibule.

Bracing was installed between the doors to prevent deflection during installation and both the outer and inner doors were closed and latched.

The masonry was built up to the bottom of the sill and covered with a thick coat of cement mortar on which the device was placed. The latter was then plumbed and leveled, braced in position and built into the wall. Great care was taken to insure contact between the brickwork and all unexposed surfaces of the metal forming the frame. (See photograph Fig. 2.)

Careful examination was made of the construction in order to form an opinion regarding the practicability of installing the device in a wall opening already built and the probability of obtaining a tight joint between the frame and masonry when doors are installed under such conditions.

The inside flanges of the vestibule were made removable for the purpose of permitting the device to be installed in openings previously

Fig. 3. Showing the layout before the test. The outer door open, inner door ajar.

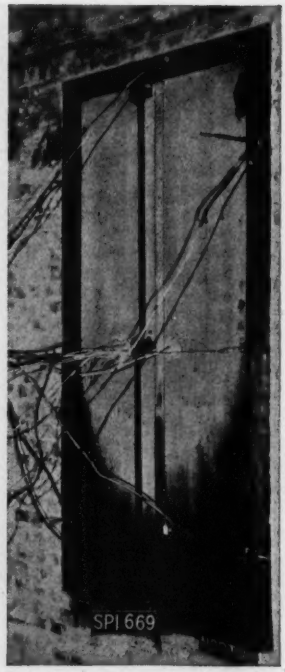


Fig. 4. The inner door before the test, showing the location of thermocouples.

prepared, and the examination indicated the necessity of having some clearance between the device and the faces of the masonry of such openings. While it is not impossible to fill this clearance space with mortar it is improbable that a tight joint will usually be secured under ordinary building conditions.

The workmanship on the sample was good, the corners were square, and welding and riveting well done.

The sample was not damaged by rough handling during shipment or during installation and the construction did not appear open to criticism as being unduly susceptible to injury.

Fire Test

The Underwriters' Laboratories standard test equipment was used. In general, the conditions of the exposure represented a fire condition in which only the door side of a vault is exposed. The radiation chamber shown in Fig. 5 was designed to simulate conditions inside the vault.

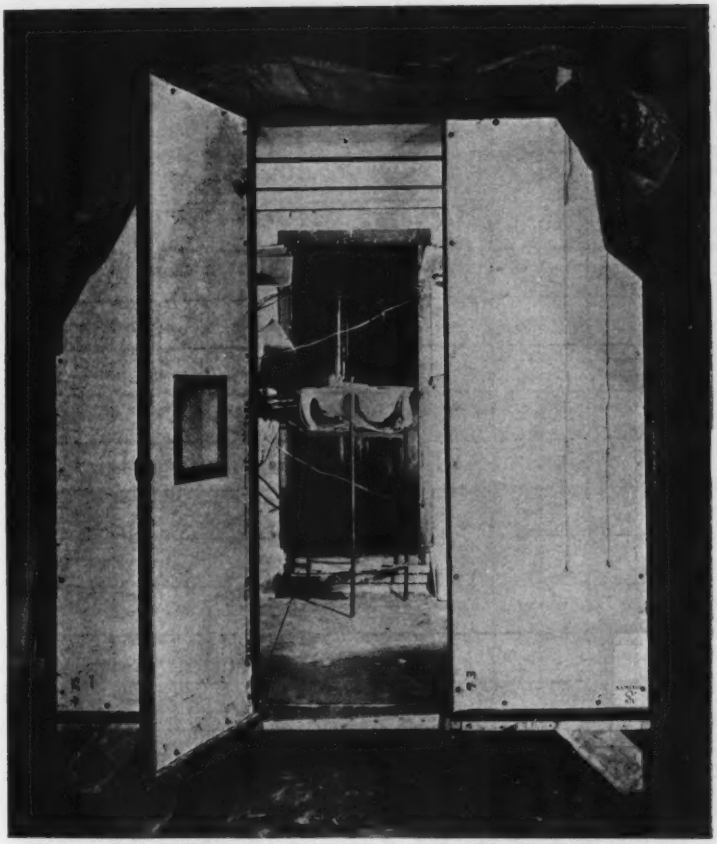


Fig. 5. Setup of apparatus before the test showing the vestibule used to make thermometer readings and observations, and the unexposed side of the inner door.

Temperature Measurements

The temperatures in the furnace were measured by the thermocouples introduced into the furnace chamber through the back wall of the furnace, the points of the couples being located 2 inches from the face of the sample at points near the top, bottom, center, and edges.

The temperatures between the doors were measured by the same method, the thermocouples being introduced through holes in the inner doors obtained by removing the handles. Temperatures were taken at a point in contact with the inner face of the exposed door (E Fig. 7), at a point 6 inches from the inside face of the same door at the middle

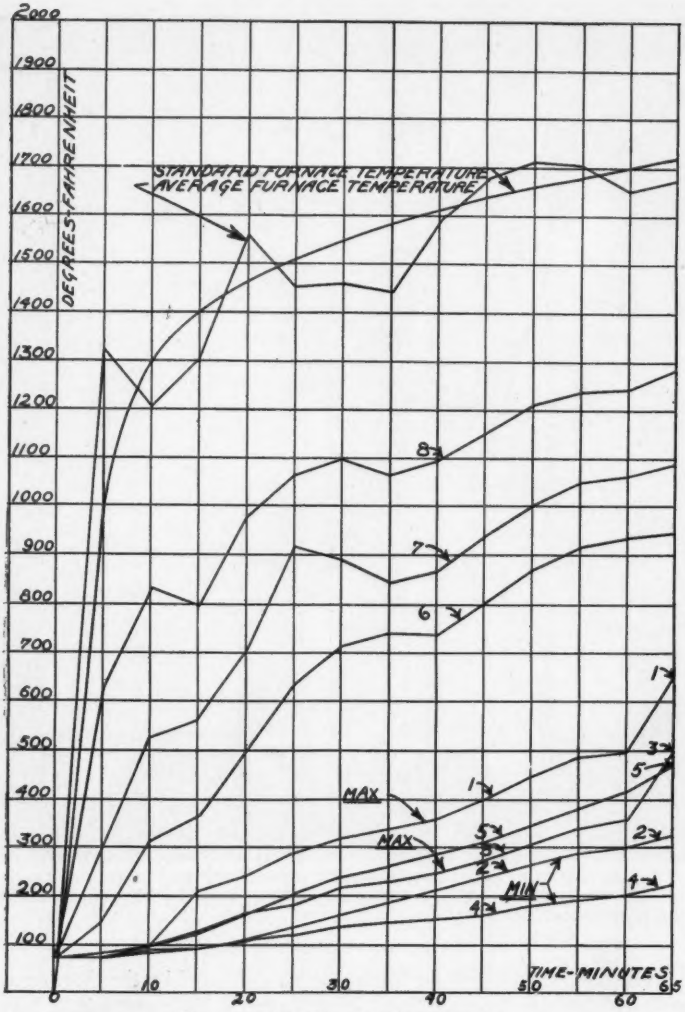


Fig. 6. Time-Temperature Curves.

The several numbered curves represent the readings of thermocouples at various locations inside the vault. See top of next page.

(D Fig. 7) and at four points 6 inches from the inside face of the door and 1 inch from the side walls (C Fig. 7); one couple on each side being 12 inches down from the top and one on each side 12 inches up from the bottom.

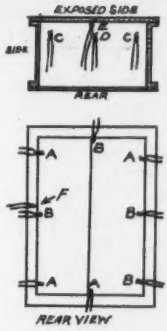


Fig. 7—Inside Couple Locations

A—Indicated on curve as No. 3 Maximum and No. 4 Minimum. Couples placed in line with rear flange joint 6 in. away.

B—Indicated on curve as No. 1 Maximum and No. 2 Minimum. Couples placed in line with rear flange joint ¼ in. away.

C—Indicated on curve as No. 6 average of four couples. Two couples placed in upper area 12 inches from top and two couples placed in lower area 12 inches from bottom. All couples 6 inches from door and 1 inch from side walls.

D—Indicated on curve as No. 7 Couple, suspended in center 6 inches away from door.

E—Indicated on curve as No. 8, placed in contact with door at center.

F—No. 5 on curve, couple imbedded ⅛ inch in metal.

Thermocouples were located in line with the inner door joint and ¼ inch away at the middle of the opening on each side at the top, and 12 inches up from the bottom (B Fig. 7).

A thermocouple was imbedded in the metal of the flange on the south side of the opening (F Fig. 7). Thermometers were suspended in line with the center of the door and about 4 feet up at points 6 inches, 30 inches and 60 inches from the inner face of the inner door. A thermometer was located on the inner wall of the radiation chamber about half way up and about 1 foot from the test wall and another thermometer was placed in a corresponding position on the outer wall.

The temperatures in the radiation chamber were measured by thermocouples and by ordinary thermometers in contact with the walls or suspended from wires stretched across the chamber. Thermocouples were located in line with the inner door joint and 6 inches away, 12 inches down from the top of the opening on each side, 12 inches up from the bottom of the opening on the south side, and at the middle of the opening at the bottom (A Fig. 7).

Readings of the temperatures indicated were taken every 5 minutes throughout the test at each location.

Papers were placed on shelves fastened to the test wall and some of the papers on each shelf were arranged to project beyond the line of the opening. A metal stand covered with papers was placed in line with the center joint of the inner doors and about 6 inches away (shown in Fig. 8).

The wall carrying the test panel was drawn into position as the front wall of the furnace; the radiation chamber placed in position and the fire started. The exposed face of the sample was subjected to standard fire conditions in which the temperatures rise rapidly to 1500° F. during the

first 30 minutes, to approximately 1700° F. in one hour, and continue to rise gradually until the end at the test in accordance with the standard curve shown in Fig. 6.

Results

CHARACTER OF FIRE: The fire was well distributed over the sample throughout the test. The average furnace temperatures are shown by the Time-Temperature Curve, also the temperatures between the doors, and on the unexposed face and in the chamber.

OBSERVATION ON EXPOSED SIDE: A slight buckle was apparent in the exposed face of the door during the first five minutes. This buckling did not increase to any marked extent during the remainder of the test. The plate forming the south jamb of the door frame bulged away from the inner member about 1½ inches during the first five minutes. The bulge increased as the test progressed, attaining a maximum about 3½ to 4 inches, shearing the rivet between these two members. This separation appeared above the lower hinge on the south edge. The jamb of the door frame on the north edge bulged slightly away from the retaining member during the test, attaining a maximum of about 1 inch at 30 minutes and remaining practically constant throughout the remainder of the test.

There was no apparent distortion or failure of the hardware throughout the test. The condition of the exposed face after exposure to standard fire conditions for 60 minutes is shown by Fig. 10.

OBSERVATIONS ON UNEXPOSED SIDE: At 1½ minutes after fire was started smoke was entering the vault chamber through the joints of the inner door.

At 3 minutes the inner door was noticeably warm and at 6 minutes was so hot that the hand could not be kept in contact with the door.

At 30 minutes the paint on the doors was blistering.

At 55 minutes the flakes of paint on the doors were glowing and papers on the stand were charring.

At 60 minutes the papers on the left hand shelf and on the stand were glowing.

At 67 minutes the papers on the stand were burning.

No flame passage through or around the door occurred during the test.

Fire was shut off at 67 minutes.

The temperatures noted during the test are shown by the curves, Fig. 6, and the location of couples by Fig. 7. Referring to these it will be noted that the temperature between the doors was above 300° F. at all points during the first ten minutes of the test; that a temperature of 300° F. was reached in 27½ minutes at a point in the radiation chamber where combustible substances might be placed; and that actual combustion took place when the temperatures indicated by the

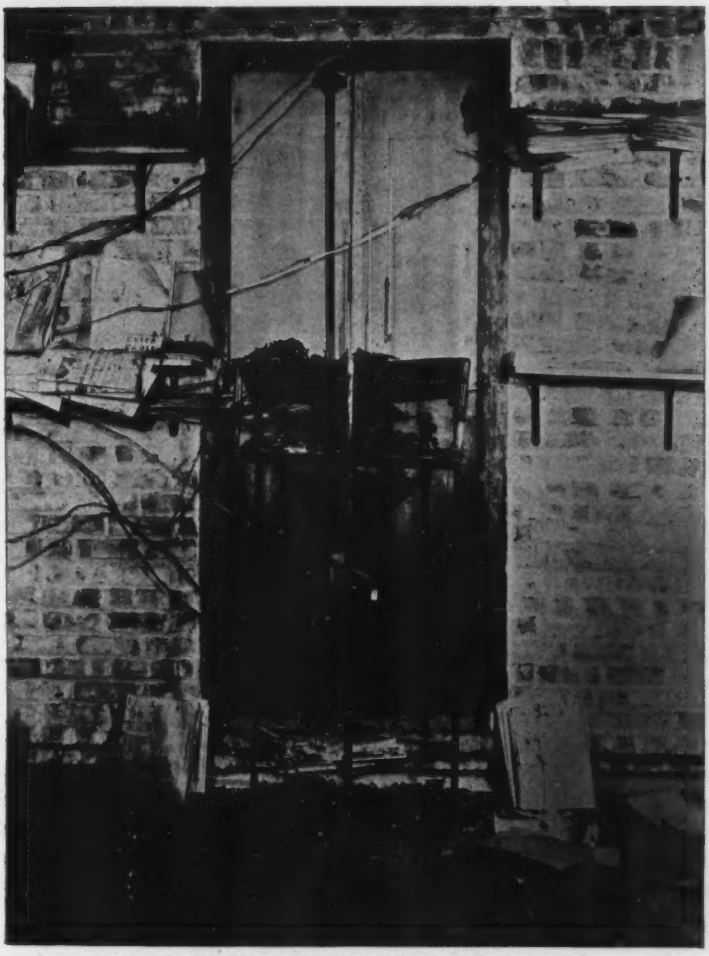


Fig. 8. Inner door after the test.

thermocouples were between four and five hundred degrees Fahrenheit. The temperatures as indicated by the thermometers in the chamber are given in the table on the next page. It will be seen that the temperature indicated by a thermometer opposite the center of the opening and 6 inches from the door was 388° F. at 60 minutes, while papers in practically the same location were charring.

The temperatures noted in the last two columns of the table are of interest as indicating the loss of heat through the walls of the chamber.

Thermometer Temperatures on Interior of Vault

Time Minutes	No. 1 6 inches from door	No. 2 30 inches from door	No. 3 60 inches from door	No. 4 Inside against wall	No. 5 Outside against wall
0	68	68	68	68	68
5	72	72	72	68	68
10	94			70	68
15	114	90	86	73	69
20	152	106	98	78	70
25	180	120	110	93	74
30	232	142	128	95	82
35	238	152	138	101	84
45	276	170	157	113	94
55	364	206	190	132	105
60	388	218	202	146	110

Conclusions

PRACTICABILITY:

Doors of this general type are capable of withstanding without injury such handling as is ordinarily to be anticipated, during shipment and while being installed. The movable parts are accessible for repair. The operation is not difficult and doors of this character can be easily maintained in good condition.

The design invites neglect of precautions in installation which are believed essential to best performance of the assembly in fire.

To permit the installation of the door in an opening previously prepared it would be necessary to make the opening approximately an inch larger than the vestibule with flange plates removed. Assuming a vestibule set in such an opening it would be necessary to grout a space from one-half to one inch wide all around and 20 inches in depth. This is not impossible, but it is obvious that it would be difficult after the work is finished to distinguish a well grouted installation from one in which the joint on the unexposed face of the wall was only pointed with mortar; and as the latter method is a much quicker and cheaper method of finishing, it seems probable that it is usually followed.

FIRE RETARDANT PROPERTIES:

Doors of this general type are capable, under severe conditions of fire exposure, of protecting combustible materials inside the vault for a period of approximately one-half hour.

It is obvious that conclusions on performance based on the results of one test are open to criticism and that tests of uninsulated vault doors of different construction might give different results. But admitting the limitations of the data it is believed that the sample tested was fairly representative of the class and that the test results are typical and representative.

Fig. 9. The outer door, closed and ready for the test.

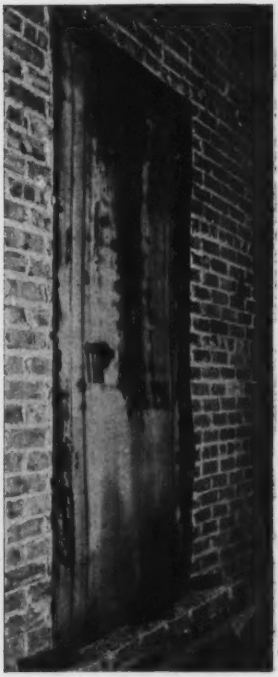


Fig. 10. The outer door after the test.

The conclusion is based on the assumption that the vestibule is properly installed and thoroughly grouted and that both outer and inner doors are closed and latched, the investigation furnishing no data on the fire resistance of the device under other conditions.

It is probable that in some cases it is not customary to close both inner and outer door of vaults, especially when such vaults do not contain currency, and that the period during which the device affords effective fire protection under such conditions would be materially reduced. It is desirable that doors of this general type should be equipped with an interlocking device which will insure the closing of both inner doors before the outer door can be latched shut.

The estimate of one-half hour protection is in part determined by the fact that many vaults equipped with this type of door have preserved their contents in actual fires; considered alone, the test results and conditions would seem to dictate a somewhat lower estimate.

The device tested is believed to be a fairly good device of the class; the outer door being secured at ten points, and the inner at three, and both

doors closing against stops all around. When in the closed position the outer door was flush with the flanges of the frame and remained so throughout the test.

It will be noted that the installation of couples and thermometers was such that they were not quickly susceptible to the influence of heat radiated from the inside walls of the chamber and that the construction of the chamber permitted the loss of some heat. Nevertheless a temperature of 300° F. was noted at 27½ minutes.

The combustible material which first took fire was sufficient in volume to intercept a rather liberal amount of radiation from the test sample, thereby contributing to increase of its own temperature, and it will be noted that this material was burning at the same time that a thermometer near it registered only 388° F.

During the test the door of the radiation chamber was opened every five minutes to permit the entrance and exit of an observer and some heat was probably lost at these times, although a curtain was placed over the door in such a manner as to form an equalizing chamber.

It is believed that the device was installed in the wall much more carefully than such devices are usually installed in the field, although the effects of improper installation could only be determined by additional tests.

Summarizing the above it would appear that the conditions of test were such as to make the sample show to advantage, and taking into consideration these conditions and the results of the test, it is believed that the ½-hour period of protection for which this type of door is recommended constitutes a liberal interpretation of the test results.

NOTE:—This article consists of extracts from Underwriters' Laboratories' report, SBI-669. In the test and preparation of this report, the writer was assisted by Assistant Engineers A. J. Steiner, M. J. O'Brien, C. A. Menzel, H. M. Robinson, and Laboratory Assistant M. Melnick.

The Youngest Fire Department.

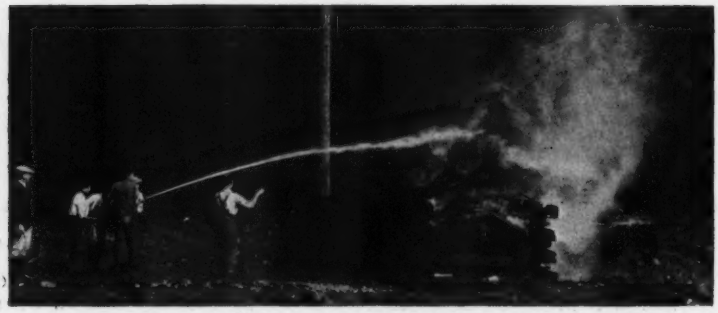
By G. L. Knotts.

E. I. dupont de Nemours & Co. (Member N. F. P. A.)

The small boy has always been counted among the fire hazards that are difficult to control. In our village at Dupont, Washington, the problem has been solved in a unique manner by the organization of a Junior Volunteer Fire Company. This has brought the youth of the village into the classification of assets in the fire fighting machinery instead of listing them as liabilities. This junior company is composed of boys ranging from 12 to 15 years of age, none of whom are ever guilty of carrying matches, and every one of whom is an enthusiastic supporter of the doctrine of safety first in the handling of fire.

Under the direction of the writer the company was brought into being with a chief elected by the boys themselves, who appointed their assistant chief and captains of the various streets. From the first the dignity of the movement was impressed upon the boys by turning the fire fighting apparatus of the village over to them as completely as though the new company were composed of men. No reservations were made and the turning out of the hose carts for drill caused bewilderment of the mothers, fathers, and the smaller brothers and sisters of the members of the company. The crowning glory of the honor of being members of the company came one day last fall when the boys touched a match to

The junior fire company of the village of Dupont, Washington. The age of its members ranges from 12 to 15 years.



The company extinguishing a fire built to practice on. Their choice of a location for their fire might be criticized as being too near to the fine grove of evergreens shown in the background.

a make-believe building which they had erected themselves out of discarded cross ties and then made a spectacular run through the main street, with all traffic halted for the occasion, connected the hose to a fire plug, and extinguished the fire.

The thrill of the feel of the water in the hose as it played on a real blaze furnished the culminating sensation that was required to make the boys understand they were real fire fighters and will be counted on by the management of the Dupont plant to take charge of affairs in the village in case of emergency, secure in the assurance that their place is on the fighting line and that their presence and assistance will be welcomed. This will be a radical change from the usual circumstance surrounding the small boy at a fire, where he has always been considered a nuisance.

Upon the arrival of men, the boys will immediately surrender their streams to the men and assume the duty of patroling the burning area. In all of the drills the actual fire apparatus has been used and the boys have a good working knowledge of the equipment, the location of hydrants and the proper method of getting water on a fire to accomplish the best results in the most speedy manner.

While no actual occasion has yet arisen for the boys to get into action, it is felt that the working knowledge and the assurance already attained will prove valuable in an emergency during the interval that must elapse between the time of the alarm and the period when the men of the village departments can get to the scene.

The boys hold weekly meetings in the writer's office located in the village, with the writer as chairman of the meeting. They have their own secretary and treasurer and have adopted the following rules:

1. Be on time at all meetings.
2. Always stick up for the Company.
3. Never carry matches, and report any children to their parents who are seen playing with matches.
4. Never play with fire equipment nor allow anyone else to meddle with it.
5. Always report fire hazards at once.

The duties of this Company are as follows:

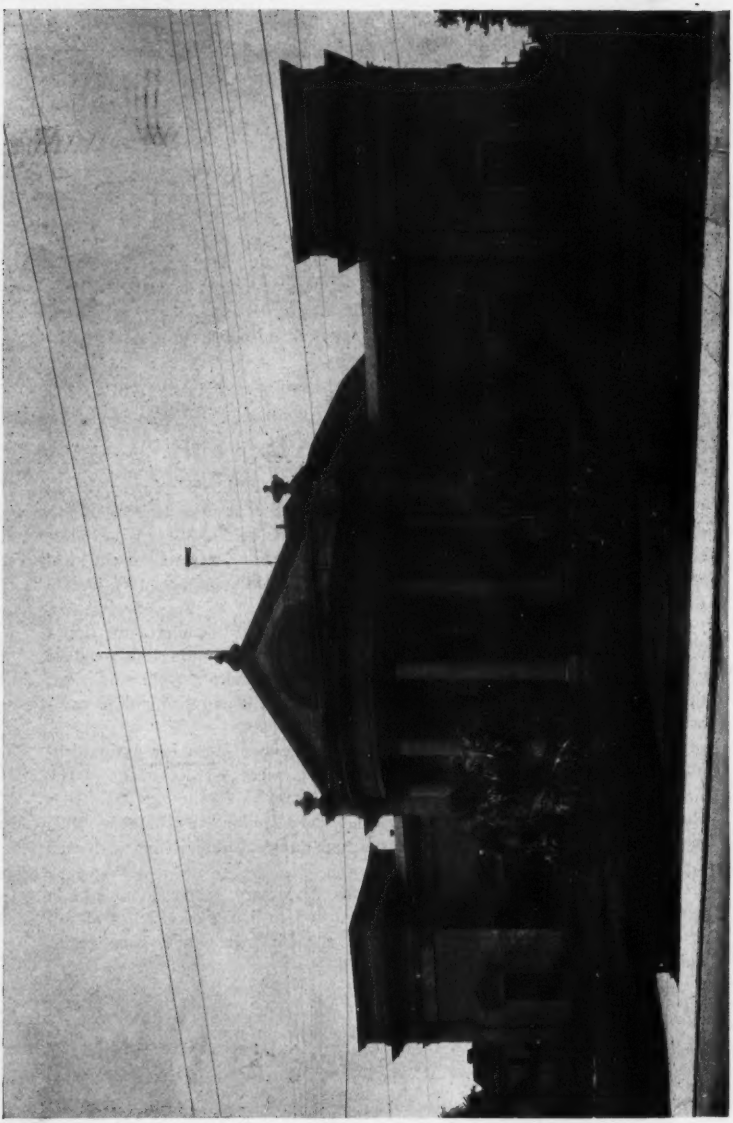
1. Make weekly inspections of all hose houses in the village to see if night lights are burning, ladders are in place, and that no obstructions are present to prevent getting hose carts out of house.
2. Curb the match carrying tendencies of small children.
3. In case of fire turn in alarm, and get hose cart to scene of fire as quickly as possible; connect hose to hydrant and get water on fire; upon arrival of men surrender the hose to them and assume duties as scout patrol.

Extinguishing Aluminum Dust Fires.

Alan Leighton, physical chemist, Bureau of Animal Industry, U. S. Department of Agriculture, states that aluminum dust fires are difficult to extinguish, owing to the reducing action of the hot aluminum on most substances used in the ordinary chemical extinguisher and to the chemical action between powdered aluminum and water. When sodium carbonate was applied to red hot aluminum, to the amazement of the investigators, an explosion usually resulted. It was found that red hot aluminum would reduce the carbon dioxide of the carbonate and that it would also reduce gaseous carbon dioxide. This would indicate that under certain conditions the addition of magnesia to aluminum bronze would perhaps aid in combustion.

Some experiments were conducted in the use of foam for extinguishing aluminum dust fires. These experiments were wholly unsuccessful, since both the water and the carbon dioxide were as fuel to the fire. It is also believed that red hot aluminum can reduce carbon tetrachloride. This means that care would have to be used in extinguishing a fire with this material.

Ordinary salt proved to be a most satisfactory material for use in extinguishing aluminum dust fires. If poured on a pile of red hot aluminum it melts on the surface and forms a thick crust which soon extinguishes the blaze.



Courtesy American Association of Museums.

The oldest Museum in the United States, at Charleston, S. C., organized in 1823.

Museum Fire Prevention.

By Edward R. Hardy.*
(Member N. F. P. A.)

American museums have been fortunate so far as loss by fire is concerned, because the records show a comparative immunity from any severe fire, although minor losses have occurred from time to time. Until the last year, when a committee was appointed by the American Association of Museums to study them, no attempt had ever been made to collect information in regard to the facilities for fire prevention in museums. As will be shown later, the subject has received very careful consideration in a large number of American museums. But this was wholly individual activity, and no concerted effort had been made on the subject until the Association appointed the committee on fire hazards. The work of the committee for this first year consisted primarily in an endeavor to find out the exact conditions in regard to fire prevention in each museum that was a member of the Association.

Replies to a questionnaire were received from 75 per cent. of the membership of the Association, which, considering the fact that the movement is new, may be deemed fairly encouraging. These replies were generally quite complete, showing a recognition of the fire hazard in museums. They stated the means taken for fire prevention. In many cases, the means are of the simplest and do not extend beyond the provision of fire pails; but the range was quite extensive and in at least one or two cases the only thing lacking to put the museum in the 100 per cent class is a system of sprinklers throughout the building. In these few cases where the standard is very high, sprinkler protection has been provided for all working departments and in one case that means complete sprinkler protection for everything below the grade level.

CONSTRUCTION: The construction of museums that reported showed thirty-four were fire-resistive, eight classed as semi-fire-resistive, eleven as non-fire-resistive, and three as frame.

EQUIPMENT: The equipment reported in fifty-two cases was limited to fire pails and extinguishers; in twenty-seven cases there were standpipe and hose; six, automatic pumps, and in eight cases a partial sprinkler equipment.

* Chairman of the Committee on Fire Hazards of the American Association of Museums.

Courtesy American Association of Museums.
The oldest Museum in the United States, at Charleston, S. C., organized in 1823.

WATCHMAN SERVICE: Watchman service is maintained in twenty-six museums, the records in such cases being local, while in twelve instances the watchman service was checked by a central station system.

HEATING: The heating plant in eleven museums was placed outside of the building, and in four cases it was in a fire-resistive room inside the building.

LIGHTING: The danger of lighting is beginning to be recognized as shown by the fact that in two museums the electric current is shut off at night, while in seven other museums the fact was emphasized that the electric wiring was inspected at frequent intervals.

SMOKING: In nine cases only was the subject of smoking referred to; in four of these it was prohibited entirely, and in five it was permissible in certain rooms. Smoking refers to the employes and not, of course, to the visitors, who would not, wandering about as they do in a promiscuous manner, be allowed to smoke. One curator stated that he had found it extremely desirable to permit a place for smoking, and felt that he was much safer in handling the matter in that way than by prohibiting it altogether. He was more in fear of surreptitious smoking than he was of smoking in a prescribed place.

INSPECTIONS: Eight museums reported that the city fire department or the underwriters, in some cases both, made a certain number of inspections during the year.

FIRE DRILLS: The value of a fire drill in public places is now well realized and a beginning, at least, on this form of fire prevention has been developed, because seven museums report that, with the assistance of the fire department, they have established such drills.

FIRES: The replies received to this question numbered fifty-three. Thirty-six reported no fires and seventeen reported fires. The total number of fires reported in the seventeen cases was thirty-four. In the case of one museum, and it is not a small one, they reported three fires, I believe, in one year, all due to the same cause, namely, spontaneous ignition of oily rags. It is needless to state that this one museum has at least made ample provision for taking care of that hazard.

Field Work.

The committee was enabled to do a slight amount of field work, but not as much as would have been desired. But there was a sufficient amount done to bring out very clearly the hazards of museums. The real hazard of any museum is not found in the exhibition rooms. The spotless cleanliness and absence of practically everything which would cause a fire does not permit much danger in those parts of the museum. The danger comes from the enormous number of activities which it is neces-

sary to conduct in a museum for the purpose of properly caring for and exhibiting the objects. Unless one has actually inspected the working departments of a museum, he can have but little idea of the immense amount of activity and the hazards introduced.

The Museum Activities.

For the purpose of illustrating these various activities, a list is furnished, but it is by no means complete, in one museum.

Photographers' Studio
Printing Shop
Restaurant
Carpenter Shop
Paint Shop
Upholsterers' Shop
Metal Case and Machine Shop
Repair Shop for Art Objects
Letterers' Shop
Moulders' Shop
Masons and Helpers
Gilding Shop
Roofers
Stock Clerks
Packing Room
Armor Department Shop

An experienced fire prevention engineer recognizes the dangers existing in all these forms of activity; but perhaps unless he has had occasion to go through a museum, he does not realize that so many forms of work are necessary. These activities and their dangers need not be elaborated in this article. There has been omitted from the list the rest rooms of the employes, and inasmuch as some of the largest museums employ in the neighborhood of four hundred persons, it will be appreciated that these facilities, especially as smoking is permitted, furnish a certain element of danger.

The Nitrocellulose Film.

All museums at the present day and for some years, in fact, have had photographs made for sale or distribution, of different specimens or paintings. In some cases, this is quite an activity. This has meant in time the collection of a large number of negatives, and the problem of properly caring for the glass negative was one to which every museum director had to give his attention. With the advent of the film, it was realized that here was a cheaper process of making the initial plate and also a process which would enable many more plates to be stored in the same space. All well and good; but nitrocellulose is nitrocellulose, and it is immaterial whether it be in a motion picture house or in a museum or a hospital; it is dangerous and will burn as readily in one place as in another. This, it seems, is one of the pressing dangers that confronts our museums. A person who is using a certain material becomes accustomed to it and if it is satisfactory for his purpose, is inclined to overlook certain dangers, especially that of fire. But the rapid development of the use of the nitrocellulose film, with the consequent increase of the quantities stored in the museums, presents a danger which should receive the earnest thought and care of every museum director.

An Experience.

The committee was consulted in regard to the installation of sprinklers by those interested in a new museum that was approaching completion in an important American city. The committee was enabled from the replies received to furnish very definite information on the subject and felt a little happy in the thought that it had at least secured sprinklers in all the working departments of one museum. The matter was followed up, however, and the information gained that an important member of the building committee and an owner of a department store that was sprinklered, had advised against sprinkling any part of the museum on the ground that it might injure some of the exhibits. This experience is cited for the purpose of showing that the American, even in museum work, runs true to form. He wants to know all about the danger; then calmly assumes that he knows more than those who may, in a sense, be considered experts on the matter.

Insurance.

Very few of the American museums carry insurance. In one case, apparently, and only one, full insurance is carried, but in most cases there is none. This is due many times to the fact that the museum is a public property and so insurance is not carried on the museum because it is not carried on many other public buildings such as schools. Again, a certain spirit of economy accounts for the lack of insurance; and again, the difficulty of fixing a value on the exhibits is another deterrent.

A Recent Fire.

A fire recently occurred in a museum in the middle west and the curator has very kindly furnished a letter describing the fire; it tells its own story, and needs no comment. It reads as follows:

Replying to your inquiry of December 23, there is very little more to say in regard to the destruction of the Joseph Moore Museum than is contained in the notice in the Museum News for December 15. I recall your careful work as a member of the Committee on Fire Hazards, and we appreciated the suggestions which your committee gave. We were, however, unable to go farther in our precautions against loss by fire than we had already gone, and it seemed that we had little to fear since there were no fires in the building which could become a source of danger. Standpipe was at hand in the building and a night watchman made regular rounds. The evidence at hand, however, is that the fire was of incendiary origin since, when it was discovered, it had already got beyond control from basement to third floor and attic above in less than one hour after the time when the night watchman had gone through the building and found everything safe. There were no openings nor communicating stairways by which fire could have gained such a headway in that time unaided. Unfortunately, responsibility has not yet been fixed, and it is, of course, very uncertain as to whether definite information can ever be secured.

The building was of brick with numerous brick partition walls within, but the floors were of wood and so when once started the entire interior burned out rapidly. The fact that extraordinary attempt was made by the firemen to save the museum resulted in a checking of flames in that part of the building so that the salvage was seventy-five per cent, as estimated, of the specimens in the museum. Only one or two other rooms were saved from complete destruction.

Needless to say, the new building which is being planned to replace the one which was destroyed will be strictly "fireproof" in construction. If there are any suggestions in addition to those which your committee has already sent out, we shall be glad to receive them.

European Museums.

The committee communicated with the British Museum and also the museums in France. Both replies are included in this article as being of permanent interest.

British Museum.

STAFF. The Museum may not be left without an Officer in charge within the precincts so that orders may be given for its safety in case of fire or other accident. There are seven firemen employed by the Trustees, who are resident on the Museum premises. These are experienced men that have in most cases served under the London Fire Brigade before being engaged by the Museum. Besides firemen, we have residential employees called Hall Clerks, and a certain number of Metropolitan Police Constables. After the Museum is closed for the day, it is the duty of a Hall Clerk, accompanied by a member of the Police force, and a fireman, to patrol all parts of the building at appointed hours. It is required that records of these patrols shall be kept in report books, which are submitted to the Director on the morning of each week-day.

The firemen are under the control of the Clerk of Works (who is an official of the establishment of H. M. Office of Works). During the months of April to September they take part in monthly fire-drills. In addition there are during the year periodical inspections of the fire-prevention plant; the Chief of Works has to be present at these, and at two of them also the Chief Officer, or his deputy, of the London Fire Brigade. An inspection is a practical feature of the system inasmuch as it involves the working with water of hydrants, hand pumps, hose and gear. The Fire Brigade Officer is also authorized to visit at Museums at any hour in order to satisfy himself that all necessary precautions against fire are being taken. It is incumbent on the Clerk of Works to provide that the water and gas services, and the fire-prevention plant, should be in working order, and that all stoves, chimneys, and flues—other than boiler-flues—should be swept at the proper time. I need hardly add that self-explanatory regulations exist with regard to the lighting of fires, the restricted use of candles, and the special watching by the Police during the night of the Binders' workshops.

It will be noticed from the above that an important part of the Museum system of safe-guard against fire dangers is the share taken in it by Officers of the London Fire Brigade, who report to the Director after inspections, and, if necessary, advise, and in case of actual outbreak of fire, would take command in measures to subdue it.

ALARM APPARATUS. This consists of 11 pulls, 14 bells, and 5 indicators situated at suitable spots, and tested daily by the District Engineer (also an official of H. M. Office of Works). In addition there are telephones (at 22 points) especially

provided for the fire-service, the lines leading to a general switchboard situated in the Museum firemen's watch-room.

WATER SERVICE. Two ten-inch mains, supplied by a sixteen-inch main of the London Water Board, feed, one of them, the ringmains and branches serving the hydrants of the older portion of the Museum buildings, the hydrants of the Binders' workshops, the underground tank in the front courtyard, and two other underground storage-tanks; the other of them the high-pressure hydrants of the new building. For emergencies there is also a connection (shut off) with the London Water Board's main to the south of the Museum premises. Furthermore, on the roof there is a main of three-inch internal diameter, following the outline of the principal building, the White wing, and the dome of the Reading Room, and running the length of the lower roof on the western side of the Museum. Connected with it are two special dry rising-mains—these for use in emergency by the men of the London Fire Brigade.

Internally the Museum is supplied with pipes of three-inch internal diameter, which are kept charged by pressure from rising-mains.

In the event of failure of public supply of water, the storage water can be drawn on; the internal system and ground-hydrants can be charged by means of a Fire Brigade pump attached to a double inlet from the underground tanks, or by a steam pump in the new boiler-house.

As part of the general exposition of Museum conditions, I should explain that the Museum galleries, the reading room, studies, and workrooms are illuminated by the electric light, and that the galleries, store-rooms of the library, and the workrooms generally are heated by steam; the use of coal fires is confined to officers' studies.

The Natural History Museum, South Kensington, is a branch of the British Museum, and the fire prevention arrangements there are similar to those in force at this institution.

French Museums.

The Louvre is protected against fire by a system consisting of 216 40 mm. (1½ in.) hose stations, supplied by five connections from the municipal water mains which have a usual pressure of 4 kg. (57 lbs.). There is one 100 mm. (4 in.) hydrant in one of the courts, and in another a reservoir of 420 cubic meters (62,500 gals.) capacity. There are eight private telephones used for alarm purposes connected directly to the fire department.

Luxembourg Museum. This museum has three 40 mm. (1½ in.) hose connections. There is a public fire alarm station about 100 meters (330 ft.) from the entrance.

Versailles Museum. This museum is protected by a network of water mains supplying 100 mm. (4 in.) hydrants and small hose connections distributed throughout the building. This protection is considered inadequate and steps are now being taken to improve it.

Trianon Museum. Here the protection consists of two hand pumps, twenty-one small hose connections, and three larger hose connections to protect a theatre stage. This protection also is soon to be strengthened.

St. Germain Museum. This museum is protected by two fire extinguishers on the stairways and five on the upper terraces.

These various fire protection measures are supplemented at the various museums by monthly inspections by the fire department with drills and tests of apparatus.

Conclusions.

There are certain types of property in which the matter of fire prevention ought to be considered and provided, irrespective of any direct financial return. Every museum is a custodian of treasures which are irreplaceable if once destroyed. There rests, therefore, upon those in charge of such properties a peculiar degree of responsibility to see, just so far as is in their power, that the rare gifts entrusted to their keeping for the benefit of the community shall not suffer loss by fire when the knowledge for its prevention is so well developed and may be had, in the case of these properties, without cost. It is serious enough to burn factories and mercantile properties, but in most cases, the goods destroyed and the building can be replaced. Not so with the contents of a museum. If destroyed they are irreplaceable, in most cases, and the money that was given for the building itself may not be easy to resecure, if through the neglect of those in charge it has been wantonly sacrificed. To realize the danger is not sufficient, as the whole campaign for fire prevention in the United States and Canada shows. What is needed is an application to the problem of knowledge which is available. The American museum is only in its infancy. It is going to play, in the educational life of the community where it is located, a far larger part than it has in the past. It is, therefore, all the more incumbent upon those charged with its care to see that it is not destroyed by fire and that the community retains intact this one of its most important, esthetic, and educational privileges.

A Rubbish Burning Hazard.

The accompanying photograph was taken by Member A. N. Miner, Jr., in Rockwell City, Iowa, while motoring through that section of the country. The arrow indicates where a bonfire for burning rubbish has been built. Mr. Miner comments that it seems to be a common practice in many small Western cities to thus burn rubbish in areas near buildings. Sometimes a wire enclosure is used, but these enclosures are constructed with such large mesh that they are ineffective.

The conditions shown in this picture invite fire. The rubbish near the bonfire and readily combustible litter piled against the unprotected windows form an almost perfect train to lead the fire from its point of origin into adjacent buildings.

Woodworkers; Their Hazards.

By Edmond F. Sisson
Wisconsin Inspection Bureau (Member N. F. P. A.)

Woodworkers, with their quantities of readily flammable waste, have been the subject of much consideration since the beginning of the power machine era. As an example of two extremes of hazard, a dwelling and a furniture factory have often been compared.

The author has recently had occasion to visit a number of these plants in and about Milwaukee and the hazardous conditions found for the most part permit of such easy correction that he has been prompted to offer these suggestions, which apply as well to the two-man shop, as to the four or five-story sprinklered furniture factory.

For this consideration let us ask the question, "Wherein are the causative hazards existing in this class?", and then outline the work done and attempt to differentiate between safe and unsafe conditions. In a general way, we may say that lumber is the raw material, and after being either air or kiln dried, it is cut, planed, joined, turned, stained, varnished or painted as the requirements of the finished product indicate. This brings us to our first distinction in hazard and for lack of better names we will call them preparatory hazards and finishing hazards.

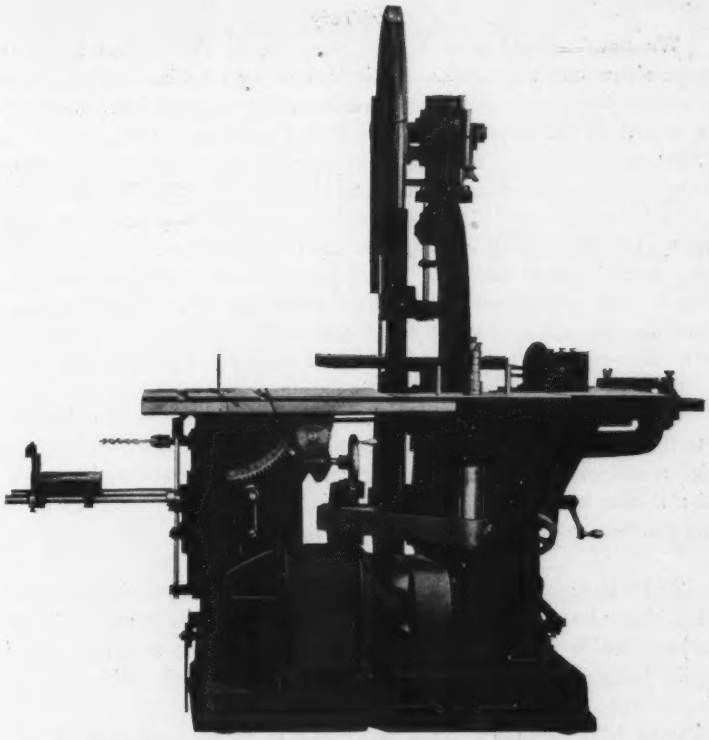
The Dry Kiln

Under the preparatory hazards the first mentioned is the dry kiln, and it is only within the past ten years that particular attention has been given to its construction and operation, and this with the advent of a number of patented kilns designed to speed the drying, prevent checking, and in general to introduce efficiency in a rather backward branch of the industry. Kiln drying is the process of removing a large portion of the natural sap and occluded and absorbed moisture by the application of heat; in the newer kilns by the application of heat and control of the humidity. Lumber is placed in the kilns with air spaces around each piece to facilitate equal drying throughout the pile. Heat is applied either by steam pipes at the bottom or sides or by heated air blown through the kiln. An ideal kiln would, of course, be of fire-resistive construction, not merely incombustible, with either rolling steel shutters or three-ply tin-clad doors at the entrance. The kiln would be vented by means of either metal or masonry stacks, though from both a service standpoint and a fire protection standpoint the masonry vent should be given preference.

To date the steam jet holds first place among the protective devices, and hand in hand with this and necessary adjuncts to it, are the "volume damper" and the quick-acting valve located at a safe and convenient distance from the kiln. In the newer batteries of kilns the quick-acting valve is placed in the operating tunnel which is usually of concrete. The volume dampers are devices which might be likened to the automatic cut-off valves in oil lines, in that they permit the passage of small quantities of vapors at low velocities but close when the velocity reaches a predetermined maximum, which would be the condition when large quantities of steam are admitted to the kiln by the jet.

Of secondary importance are automatic sprinklers. In the author's opinion their effectiveness is seriously impaired due to the accepted method of placing the timber in the kiln. This much, however, is to be said in their favor, they are automatic. It is necessary, though, to use high temperature heads. "Rate of rise" fire alarms might possibly be used to advantage, if adjusted for the normal temperature variations in the kiln, though this would, of course, cause a decrease in sensitiveness. So far we have dealt with the ideal kiln, the exceptional one, as found in the field. What we actually find range all the way from all wood kilns with no protective devices to an approximation of the ideal kiln described above. That kilns deserve especial attention may be readily seen from the N. F. P. A. fire record figures (QUARTERLY, Vol. 16, No. 3, p. 300), which allocates to dry kilns 32% of all fires in woodworkers of special hazard origin.

Where frame dry kilns are encountered in the field, the recommendations may be almost standardized to the following: Install a steam jet and quick-acting valve and line the interior, including the door, with ¼-inch hard asbestos board and install on top of this a terne or ordinary roofing plate. Either one alone is insufficient; the asbestos alone is subject to mechanical damage in service, and the metal surfacing has practically no insulating value. Care must be exercised to see that a proper manually operated damper is installed in the vents, preferably operated by the same control lever that operates the quick-acting valve. Steam jets or other protective devices are of doubtful value if the kiln is not lined, since both the contents and the kiln are combustible and the material of the kiln has been subject to continuous heating, very probably with the formation of pyrophoric carbon subject to self-ignition at temperatures lower than are found commonly in kilns. Where steam pipes are found along the bottom of the kiln, efforts should be made to have them placed at the sides on iron hangars with three to four inches clear space from the combustible walls; where this is impossible they should be raised 12 inches above the floor. Where heat is obtained by means of a draft of air passing through steam coils the duct carrying the air should be of



A combination machine called a Universal Woodworker. It includes a band saw, shaper, jointer, ripper and borer. Five men can work on this machine at one time without interfering with each other.

metal throughout, and when the blower is motor driven attention should be given the electrical installation and location of fan bearings.

Next of importance, and an improvement over the frame kiln, is the brick or tile kiln with ordinary joist roof and either wood or metal door. Corrections and improvements to this type of kiln are much the same as for the frame kiln and the expenses incurred in making these improvements are more easily justified due to the more satisfactory control of fire and less serious results from it. In concluding this section pertaining to kilns, it may be well to call attention to the fact that so-called "patented" kilns do not of necessity embrace superior fire-resistive conditions but rather superiority of the drying operations. It seems from a perusal of catalogues that patented kilns may be of any construction, since they are built to suit the user's needs and designed for particular conditions.

Machinery

We have arrived now at the point where the lumber begins to change shape and appearance. This is done by machines and by hand, though, in the larger shops, handwork is rapidly disappearing. Under the fire record of the class in the N. F. P. A. QUARTERLY (Vol. 16, No. 3, p. 300) no record is set forth of a machine starting a fire with the exception of a band saw. There is doubt in the author's mind that the sawing of wood started a fire. In all probability the cause may be laid to a hot bearing, and any rapidly moving machine has this inherent hazard. With these facts in mind we have attempted to divide machines into three groups, each group being more hazardous than the preceding group. When we say hazardous, we mean hazardous first, from the nature of the refuse produced, and second, from the quantity of such refuse. This classification is given in the table on the opposite page.

In the industry itself it is obvious that there is a lack of uniformity as to the naming of these various machines, and a machine that would be called a molder by one organization would be called a shaper by another and a sticker by another. With this condition, we have used the names most generally applied in the list of the three groups.

Combination Machines

So far the author has given, in a general way, information as to type of machines; let us mention combination machines. These and their near relations are to be met with in a number of plants and their use is steadily becoming more common. The simplest type of combination machine is one on which by changing tools or discs it may be made to do a variety of work. A lathe, for instance may be so designed as to permit a sandpaper disc being attached to the head stock, or a table may be bolted to the bed plate and a shaper head attached to the head stock. This type of machine will be found in the small shop where the work is done by one or two hands and the outlay for several machines is not justifiable. When this type of machine is met, it is the author's opinion that it should be considered as hazardous as one machine doing the most hazardous work that may be done on it. Thus if it is a sander and small lathe and shaper, it should be considered to possess the hazard of a sander, since this is the most hazardous operation that may be done on this machine.

Appearing on the market in recent years are universal or variety woodworkers capable of doing several different operations. They are seldom if ever equipped with blowers and should be considered the equal in hazard of several machines doing diverse work, and for that reason they may fall into all three of groups outlined.

Having then discussed in a brief fashion the machines which do the preparatory work, we come to first motive power and next to disposal systems, including the shaving vault.

Woodworking Machines: Relative Hazard

Group 1	Group 2 (More hazardous than Group 1)	Group 3 (More hazardous than Group 2)
Saws Rip Trim Jig Band	Tenoners	Sanders Belt Drum Disc
Boring Machines	Chucks	Planers (Cutter head over 20 inches or more than one head)
Nailers	Rolishers	Lathes Back knife Madison Turning Automatic Taking stock larger than 11 inches or longer than 20 inches
Mortisers	Routers	Carvers (Making more than one replica of the model)
	Panel Raisers	Crozing Machines
	Matchers	Champing Machines
	Stickers	Barrel Finishing Lathes
	Shapers	Heading Turners
	Molders	Pail Finishing Lathes
	Jointers	Stave Scoops
	Heading Jointers	Chair Seat Scoops
	Stave Jointers	Finger Jointers (Cutter head over 20 inches or more than one cutter head)
	Dovetail Jointers	Veneer Cutters
	Carvers (Making one replica of the model)	
	Dowelers	
	Saws (with Dado, Gainer or Huther heads)	
	Lathes (Taking stock less than 11 inches in diameter and less than 20 inches in length)	
	Planers (One cutter head less than 20 inches)	
	Heading Chipper	

Motors

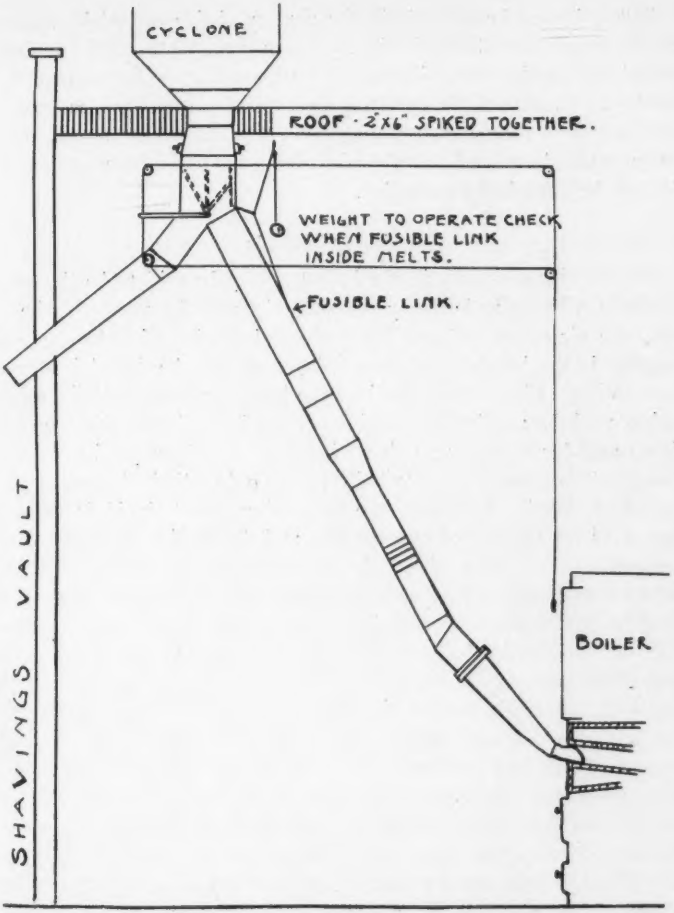
Motors suitable for use in woodworkers are of two types: totally enclosed, and self-ventilated or without moving contacts. When we say without moving contacts that should be held to mean just that, neither slip ring nor commutator type being included. Of late, repulsion-induction motors with vertical commutators have enjoyed a large sale. In these motors, when coming up to speed, the brushes rest against a vertical commutator and the rotor acts as an ordinary direct current rotor. The brushes are short-circuited on themselves, and so the motor partakes of the characteristics of a direct current motor. After reaching a predetermined speed it automatically starts to function as an ordinary induction motor. It is during the starting period of these motors that severe sparking occurs and for that reason they should be properly enclosed. Moreover, it should be well understood that there is no small hazard to

any motor, even without moving contacts, if exposed to fine dust, for this dust collects on fields, armatures and rotors, and acts as a blanket preventing the dissipation of heat incident to the motion, with the result that insulation breakdowns may occur causing short-circuits in the presence of this combustible dust.

Enclosures for motors are of two kinds, room enclosures and small enclosures. The room should be as nearly dust-proof as possible, used for no other purpose, and of such size that a man may enter and have free access to all apparatus. Walls should be preferably of incombustible construction. If of wood they should be not less than ⅞-inch matched lumber lined with ¼-inch asbestos board. The floor should be covered with one inch of concrete. The door should be of ⅞-inch matched boards lined with sheet metal. It should fit tightly and be self-closing. A window is required not less than two feet square, glazed preferably with wired glass and so placed that the apparatus may be readily seen from working floor.

Where combustible dust or flyings are prevalent in the vicinity of the room, two metal vent pipes not less than 6 inches in diameter should connect the room with the outside of the building, one at the top and the other near the floor. If the distance from the room to outside wall is great, forced ventilation may be necessary. Power transmission should be made through the smallest possible opening. The wall opening around the shaft should be closed with galvanized iron slides held in grooves. Where a room enclosure is not practicable, or the motor is small, an enclosure of similar material should be used, except that the floor may be covered with ¼-inch asbestos in lieu of concrete. The size of the enclosure should be approximately three times the volume of the motor. The height of the enclosure should be one and one-half times the height of the motor. Doors should be similar to doors for room enclosures. Windows should be one-half the height of motor but need not be larger than two feet square. Ventilation may be secured, where outside ventilation is not required by the National Electrical Code, by at least two screens, one at top and the other at bottom of the enclosure. The mesh of the screens should not be greater than sixteen. As a rough guide, the size of screen, in square inches, may be taken as the square of the diameter of the rotor. Where subject to dust or flyings, two ventilating pipes similar to the room enclosure requirements should be supplied, and this condition is by far the most common.

In addition to room and small box enclosures there may be used the enclosed motor casing, where the protection is inherent to the motor device itself. This may require a larger motor than if the motor case is not of enclosed type, but the motor size can be kept down by ventilating the interior of the casing to outside air if the distance is not too great.



A typical arrangement to use shavings as boiler fuel. (This illustration was not furnished by the author but is taken from a book, "The Woodworker," a joint production of several Lumber Mutual Insurance Companies.)

Refuse Removal Systems

Systems for the removal of refuse from machines previously discussed are in general use at present and while they serve as a means of disposing of this refuse, they introduce an additional hazard and their proper installation is of great importance. The N. F. P. A. Regulations for Blower and Exhaust Systems should be implicitly followed.

The principal hazards lie in the chance of fire caused by sparks or heat due to friction. Fans, for instance, are required to be of non-ferrous material and bearings must be outside of the casings of the system. Ducts must be of incombustible material and suitable provision be made for cleanout. It is recommended that cyclone collectors or separators and storage vaults be placed outside of buildings. The entire system is required to be electrically grounded.

Finishing Hazards

The finishing hazards in the industry may be said to be the hazards of volatile solvents and readily oxidized oils used by means of the hand brush, the air spray and the dip tank, and glaring violations of safety principles in the handling of these substances may be found in one shop after another. First, let us consider the handling of the volatile solvents, benzine, naphtha and benzole, which are used as thinners for the cheaper finishes and for a goodly number of stains. Familiarity with the nature of these solvents would seem to indicate that only a limited quantity should be kept on hand. However, the area of exposed liquid is the major measure of the amount of evaporation, and due to the nature of the surroundings the presence of a substance so easily ignited is certainly a severe hazard. Since it is necessary that they be present, the quantity should be limited to not over a day's supply. Dip tanks are in themselves a field of considerable hazard. They are not infrequently found made of wood without so much as a wooden cover. Then again they are entirely of metal with automatic covers, overflow pipes and foam extinguishing devices. Ideal conditions would require them to be as small as possible, of metal riveted and soldered with metal hinged covers, counterbalanced open, with a stop to prevent the cover being opened more than 75 degrees and a fusible link placed to free the cover from counter-balance weight in the event of fusing the link. In addition there should be a quick-acting valve in a line from the dip tank designed to rapidly empty the tank into the sewer. In addition, an overflow pipe should be placed at the top connection to the other discharge. As regards the room in which the dipping is done, it should be light and above all well ventilated. In one case a 30-gallon wood dip tank without cover was placed in a small wall board enclosure together with an open flame gas japan oven, and the window serving this section was nailed shut. This may be said to represent entirely incorrect conditions. (See Regulations for Dip Tanks.)

The drying or oxidizing oils, linseed in particular, while not having the hazard of low flash point, introduce the hazards of spontaneous ignition. That is, when exposed to air on cloth, shavings or any substance offering a comparatively large area to volume, these oils on taking up

oxygen from the air generate heat. When conditions are such that this heat is not dissipated, the temperature rises till ignition occurs. For this reason it is absolutely necessary to provide suitable waste cans of metal with covers for the disposal of rags and metal lockers for workmen's clothes. This does not mean ordinary open metal kegs but rugged metal containers with 4-inch metal legs and self-closing covers. When considering fires from unknown causes it is to be wondered how many are directly chargeable to this condition.

To conclude then this section on finishing hazards, let us make the following conditions by-words:

1. Limit the quantity of flammable liquid to not over one day's supply.
2. Ventilate adequately.
3. Dispose of all oily waste.
4. Use suitable protective devices on dip tanks.

From an examination of fire causes of the class in the QUARTERLY we find that "common causes" are by far in the ascendency, since over two-thirds of the fires on which accurate information was available are under the heading common causes, which include boiler and fuel, power, smoking, lighting, heating, rubbish and so forth. Such information as this would seem to indicate that housekeeping conditions (for that is another name for "common causes"), should be of first importance. Just as a given 10,000 of bracket chimneys will cause a higher average number of fires than 10,000 built "from ground," so will a given number of boilers dangerously placed, or a given number of oily rubbing cloths not properly disposed of, cause a greater number of fires than if properly placed or properly disposed of.

The writer has throughout this discussion made numerous specific recommendations as to practices to follow in abating hazards. While, too, an attempt has been made to emphasize the results that are to be obtained, it is felt that the recommendations may be helpful. In most cases there are existing regulations recommended by the N. F. P. A. which apply. In general, also, the Inspection Department having jurisdiction can be expected to furnish helpful advice.

Crepe Rubber Soles.

By Wm. G. Hayne, Engineer.
New York Board of Fire Underwriters (Member N. F. P. A.).

Crepe rubber, a good grade of crude unvulcanized rubber, has recently come into considerable use in the manufacture of shoes, being used for soles. When first introduced about two years ago it was placed only on sport shoes and the quantity used was small. Since then, however, it has come to be used on many of the ordinary types of footwear.

It derives its name from its crinkled or crimped appearance and the greater quantity of it comes from the Malay Peninsula, being shipped in sheets usually 13 by 37 inches dimensions and from 1/16th to 3/8ths inch thick. These sheets are packed in boxes, sheets of paper separating the individual sheets of rubber, which weigh from 180 to 200 pounds each. The shipping and storing involves no particular fire hazard but when used in shoe manufacture, hazardous processes are involved.

Hazards of Processes.

These processes are started when the cases containing the rubber are opened and a thin layer of leather is glued or cemented to one side of some of the rubber sheets. The shape of a full sole and heel, known as a midsole, is then stamped out of this combination of rubber and leather by power presses. Similar pieces are stamped from the plain rubber and are used as a final sole. Pieces the shape of a heel and known as wedges are also stamped from the plain rubber.

When the upper of the shoe is completed to that point where the sole is to be applied, the midsole is cemented with rubber cement and stitched on in the same manner that ordinary leather soles are attached. The wedge or heel is then cemented to the midsole and finally the piece of plain rubber, the shape of a full sole and heel, is cemented over the wedge and the balance of the midsole. The wedge and final sole are attached only by rubber cement and are not sewed or stitched. The shoes are then taken to a machine known as the "rough rounder" which roughly trims off the surplus leather and rubber around the edge of the shoe. From the rough rounder the shoes are taken to the trimmer where the edges are made smooth and even.

The soles of the cheaper grade of shoes are shellacked and shipped in this fashion, but the soles of the welt or better made shoes are cleaned with a rough brush and when necessary with a particular liquid compounded for that purpose.

During the process large quantities of rubber cement are used. A large number of midsoles, wedges and soles are coated with rubber cement and placed on wooden racks until the cement begins to set. The number of pieces thus treated depends upon the capacity of the factory, but in any case a considerable hazard is created by the volatile fumes of the rubber cement which are given off readily and in large quantities because of the exposed total large area of the pieces so coated.

The process of stamping, stitching, etc., does not present any undue fire hazard until the trimming machines are reached. These machines are generally connected to blower systems, but the blower systems are incapable of removing the finer particles. These small particles adhere to the inside of the blower piping where they continue to collect, together with particles of leather, etc., from other machines to which the blower system is also connected. In the trimming process the edges of the soles are brought against a rapidly turning and generally rough wheel which wears the rubber down to a smooth edge. Considerable heat is created by the friction between the sole and the wheel, which at times is sufficient to ignite the small particles of rubber entering the blower system. These in turn ignite the accumulations in the blower systems and fire is caused.

The process of shellacking the cheaper grade of shoes presents only the hazard of shellac, as is commonly found where this material is used. The cleaning of the welt made shoes, however, involves the hazard of the use of a volatile liquid in a free manner and usually in an open loft.

Crepe rubber, therefore, introduces hazards into shoe factories which were not found there before, and increases some of those already there to a much greater degree. By the proper use of blower systems, thoroughly cleaning them at regular intervals, and the handling and storage of the volatile compounds according to recommended practice the hazard can be abated.

Hazards of Electric Transformers.

Transformers now form a very important part of the electrical equipment of many manufacturing plants. Generally they are reliable and safe, but the transformer equipment may be hazardous from two causes,—first, due to the high-voltage lines; and second, due to the insulating oil in the transformer cases, which may become ignited by the extremely large amount of energy available at times of short circuit.

If lines carrying high voltages should fall on buildings, a flash may occur which might ignite combustibles if any are nearby. If the lines should fall on others carrying a lower voltage and therefore not so well insulated, excessively high voltages will be impressed on the low-voltage lines and the arcing, where insulation is broken down, may cause fire.

Firemen are very reluctant to use hose streams in the vicinity of high-voltage lines owing to the fear that if the streams should be accidentally directed against the lines, severe shocks and possibly death may result. A solid stream of water applied to bare 6600-volt wires from a distance of twenty-five feet may, if conditions are right, prove fatal. To avoid these hazards, the high-voltage lines should not be run above or near valuable combustible property nor across other wires unless due precautions are taken.

The oil hazard may at first sight seem negligible because the insulating oil has a high flash point and is therefore difficult to ignite. Also the automatic protective devices usually open when a short circuit occurs in a transformer and then no fire follows.

Occasionally, however, the short circuit ignites the oil in the top of the transformer, and while a fire in the tank itself can be extinguished without great difficulty, the burning oil is sometimes thrown out of the case if enough electrical energy is available. Or if the oil is heated sufficiently, it will boil and overflow, spreading the fire over the surrounding ground or floor. Such a fire outside the transformer case is the most serious, especially with large units, each of which sometimes contains several thousand gallons of oil.

To give an idea of what happens during a transformer fire, a few actual examples are briefly described in the following paragraphs. (A Fire Record of Transformers was published in the July, 1921, QUARTERLY, Vol. 15, No. 1, p. 75.)

Reprinted from the *Factory Mutual Record*, published by The Factory Mutual Laboratories (Member N. F. P. A.).

Result of fire in a small transformer, Holyoke, Mass. A short circuit caused burning oil to be thrown from transformer case. The resulting fire boiled over the remaining oil, the flames extending above the roof of the mill. Lower windows were burned out and brickwork spalled.

Transformer Fires.

S-33759. HOLYOKE, MASS., AUGUST 24, 1922. A short circuit occurred in one of three 75 KVA 2300-550-volt oil-cooled transformers set on a low concrete platform close to the wall of a four-story brick mill. The short circuit immediately ignited the oil, some of which was thrown from the tank and burned fiercely on the ground near the transformers. The oil in the transformer must have boiled over, for after the fire none was found in the tank. A large hose stream was used on the fire as quickly as possible but it was twenty minutes before the fire was extinguished. The fire broke the glass in the windows near the fire, burned the wooden window frames, and spalled brickwork and stone window ledges of the building, as shown in the pictures above. Eyewitnesses on the opposite side of the mill stated that the flames could be seen reaching above the top of the four-story building.

The oil in the remaining two transformers was not ignited. If the transformers had been larger, and therefore had contained more oil, or if they had been located inside the building without being suitably safeguarded, it can be readily understood that much more serious consequences might have resulted.

S-38674. MURFREESBORO, TENN., SEPTEMBER, 1920. An oil-filled high-voltage bushing which passed through the concrete roof of a noncombustible substation broke down and ignited the oil, which set fire to

Ruins of a transformer substation at Murfreesboro, Tenn. A high-voltage oil-filled roof bushing broke down. The oil caught fire and ignited the oil in four large transformers, totally destroying the substation.

some combustibles in the building. The oil in four 300 KVA oil-cooled transformers inside the station became involved. There was no attendant in the substation, nor any facilities for fighting the fire which burned itself out. The building and contents were totally destroyed. The ruins are shown in an accompanying picture.

S-38673. RUMFORD FALLS, ME., MAY, 1923. While a test requiring a considerable amount of current was being made, the insulation of one of three 2500 KVA 11000-2300-volt transformers broke down. A mild explosion occurred in one of the transformer cases, blowing ignited oil to the substation roof, which was of plank covered on the under side with sheet metal. Some of the ignited oil got in behind the iron and ignited the plank roof. Fortunately, the fire was extinguished before any considerable damage was done.

Well Arranged Transformers.

The best safeguard for the oil hazard depends upon conditions. As a general thing, small transformers can be safely mounted on the outside wall of a building, but units containing more than one or two barrels of oil should be a safe distance away or well cut off from valuable buildings. It is a good idea also to slope the ground away from the building or to provide other arrangements for conducting any overflowing oil to a safe point.

The picture on the next page shows an exceptionally good arrangement which was adopted for large transformers outside of a substation. Each unit is in a separate brick cell, open at the top, and with a depressed floor drained to the sewer. Each transformer case has an overflow pipe with trap. There are no exposed wires either on the primary or the secondary sides.

An exceptionally well-arranged transformer. One of several, each between brick division-walls outside of a substation. No wires are exposed. Note overflow pipe with trap. This arrangement is suitable particularly for high voltages and large capacities.

Sometimes it is necessary to place transformers inside buildings. Usually this requires a separate non-combustible room except in special cases where conditions of construction and occupancy are such that serious damage would not result from an oil fire at the transformers. Where the transformers contain more than one hundred and fifty or two hundred gallons of oil, the floor should be drained through a trap to the sewer or other safe point.

To confine the oil, there should be a raised sill at the doorway, the opening of which should be protected by a standard fire-door. In this manner, only a small amount of oil can burn in the building, and then where it can do but little damage.

Anti-Syphoning Piping for Oil Burners.

By B. K. Breed.
Underwriters' Laboratories (Member N. F. P. A.).

The rapid increase in the number of oil burning installations, especially those for domestic use, has caused attention to be given to certain problems which may be more or less inherent in such systems. Probably one of the most common difficulties and one which may involve great hazard is the improper location of the outside fuel oil storage tank above the level of its connected piping within the building. In certain locations considerations such as rock formations, ground water, and the like make deep tank settings impracticable. In order to safeguard property endangered by the possible syphoning of oil in case of damage to the piping, some reliable means for breaking the syphon should be employed.

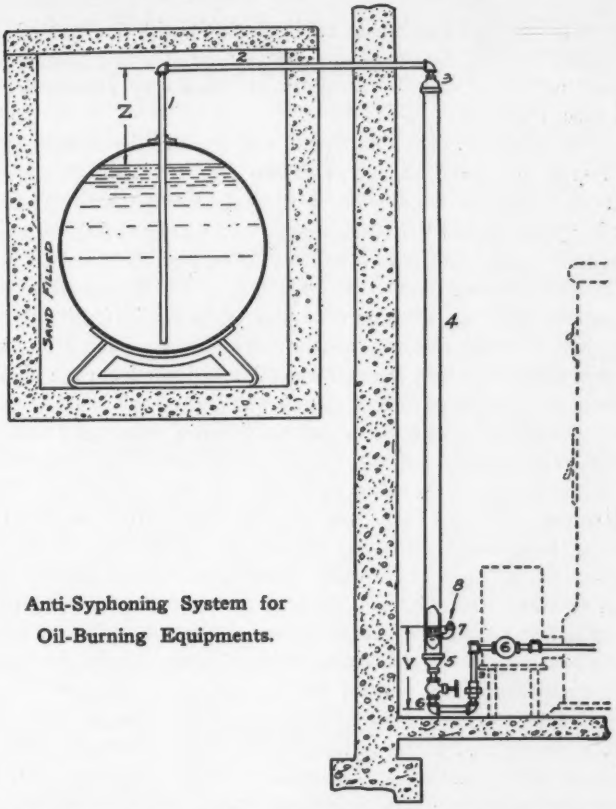
A number of systems and devices are now in use for accomplishing this result, with varying degrees of success. The purpose of this article is to describe a possible means of preventing syphoning on systems using a pump in the suction line from the storage tank. Preliminary tests have indicated that the arrangement described below may be so installed as to be effective in preventing the hazardous loss of oil through leaks or breaks in the suction line.

The system consists essentially of an oil storage tank installed at some higher point than the oil pump (6) used for drawing oil from it, the piping connecting the two being in the form of a closed syphon as shown in the accompanying sketch. The down leg (4) of the syphon is constructed of piping of larger diameter than that employed in the rest of the system.

Assuming that the pump is capable of exhausting air from the system, a vacuum or pressure reduction will be established in the pipe. When this vacuum has become sufficient to overcome the oil head (Z), oil is drawn from the storage tank, through the pipes (1) and (2), and is dropped into the top of the larger pipe (4). Entering from a smaller pipe the oil merely falls through the enlarged section collecting over the second reduction (5), whence it is fed to the pump. Some of the air entrapped by the oil in falling will continue downward with the oil and will be pumped out of the large pipe until the oil level in this pipe has

---

NOTE: Underwriters' Laboratories has not investigated the patent records for possible infringement on existing claims through the use of the above described system. This article is reprinted from *Laboratories' Data*.



Anti-Syphoning System for Oil-Burning Equipments.

been raised sufficiently to seal the remaining air in the chamber. Obviously any manner of dropping the oil into the large pipe which will break its fall or cause it to flow down the sides of the larger pipe will be of advantage in establishing a lower air seal level.

The rapid flow of oil through pipes (1) and (2), however, necessitates a somewhat higher vacuum than that needed to merely raise the oil through the head (Z), as some additional pressure reduction is required to overcome pipe or fluid friction. As the oil coming over through pipes (1) and (2) can never exceed the amount removed through the pipes (6) and (7), the larger pipe (4) will always contain some proportion of air under vacuum. When the pump is stopped, the vacuum in pipe (4), as explained above, is somewhat greater than the head of oil (Z), so that the oil will continue to flow through the pipes (1) and (2) and collect in the larger pipe (4) until the oil level in this pipe has been raised suffi-

ciently to balance the vacuum of air in pipe (4) with the head of oil (Z). Upon again starting the pump this collected oil acts as a priming charge, and must be pumped out to reestablish the necessary vacuum for a flow of oil from the tank.

In the event of a break or leak at any point in the suction line while the pump is in operation, air is drawn into the piping, reducing the vacuum and stopping the flow of oil from the storage tank. If the pump is not in operation and the break occurs above the priming oil level (V), the vacuum in pipe (4) is lost, and the oil in pipe (1) is allowed to fall back into the storage tank. If the pump is not in operation and the break occurs below the oil level (V), and if the head of priming oil (V) is less than oil head (Z), air will be drawn through the break into the vacuum chamber (4) and the priming oil will drain from the piping.

Preliminary tests have been run on two temporary installations using pumps of widely varying capacities. The first tests were run with a pump of 20 gal. per hr. capacity installed at a point 30 in. below the level of oil in the storage tank, using ⅛-in. pipe in the suction line. The horizontal section of pipe (2) in this test was carried to a height of 30 in. above the storage tank oil level. The second installation was made with a pump of 96 gal. per hr. capacity installed at a point 40 in. below the level of oil in the storage tank. The suction line was made up of ⅜-in. pipe carried to a height of 56 in. above the storage tank oil level. In both the installations the reductions from the larger to the smaller piping were accomplished in a vertical section, but no investigation has been made thus far as to the necessity of making the installation in this manner.

This system was found to be effective in detecting and stopping the flow of oil under conditions of rupture varying from very small cracks in the piping system to a full break in the line. As in many other systems, however, the effective operation was found in the tests run thus far to depend upon its installation in compliance with certain conditions as follows:

(1) a. The enlarged pipe section in the case of 20 gal. per hr. pump to have a diameter of at least three times that of the other piping.
b. The enlarged pipe section in the case of the 96 gal. per hr. pump to have a diameter of at least four times that of the other piping.

(2) The larger piping to extend above the highest possible oil level in the storage tank.

(3) The piping to be so arranged that the head of priming oil (V) can never exceed the head of oil (Z), dimension (Z) to be measured to the top of the oil storage tank.

In stating these limitations it is important to note that the necessity of increasing the pipe ratio from 3 to 4 in the case of the higher capacity pump, was probably in some measure due to the fact that in this installa-

tion the oil fell through a distance of 7 ft., while in the first installation it fell only 4 ft. The greater height of fall was probably responsible for the entrapping of considerable air and consequently a greater reduction in the speed of oil withdrawal from the large pipe was necessary to give this air a chance to separate from the oil and return to the chamber.

This description has been made with the assumption that the pump was of a type capable of producing a vacuum with air as the pumping medium. For purposes of initial starting with a pump requiring priming, a plugged street elbow (8) should be tapped into the larger section at a point which will not allow priming above the level specified in condition number 3.

Cockroach Racing as a Fire Cause.

An English correspondent of Mr. S. D. McComb, chairman of the N. F. P. A. Marine Committee, writes as follows:

> Referring to an article in a recent number of the *Nautical Magazine* about fires on board ship. The following, although not recent information, may interest you. It was told me by a man-of-war's man about fifty years ago. My informant probably started his career at sea in the early sixties, and most likely in wooden ships. Here are his own words, as near as I can remember: "Us boys used to catch cockroaches, get some small pieces of candle, light them, tilt them a bit to let the grease run, then put them on the cockroaches' backs, and have races." He then naively added: "You must not get catched at it though." I presume the bearers of the light would make for some secluded spot in the ship. Can, and do fires originate at sea like that now?

Four-Alarm Buffalo Fire.

Report by New York Fire Insurance Rating Organization
(Member N. F. P. A.)

Buffalo experienced the first four-alarm fire it had had for 26 months on Sunday, April 19, when the city firemen did commendable work in bringing the fire under control in three hours, in spite of the handicap of a delayed alarm and the headway that it had made due to high winds before the department was summoned.

Story of the Fire

The section of the city in which the fire occurred is not much frequented on Sunday. The first alarm was pulled by a civilian who saw fire coming out of second-story windows at 556 to 560 Washington Street. The first battalion chief on the scene said that as soon as the firemen left their station they could see the fire was of terrific size. He at once turned in second and third alarms and started to attack the fire on Washington Street. After turning in the second alarm, he was told that the fire had broken out on the Main Street side.

Due to the peculiar layout of the various buildings in the rear, surrounding a light court above first floor, the fire, fanned by a stiff northeast wind, quickly spread to all of the buildings involved by way of skylights and unprotected windows, so that there were fires of major size in five buildings.

The fire originated in the furniture store at 556-562 Washington Street, where there may have been an explosion, but destruction was so complete that conclusive evidence was as usual absent. This building was three stories high, with brick walls, steel, cast-iron and wooden columns and girders, and ordinary joisted floors.

The building at 554 Washington Street and 567 Main Street was one of composite type; that is, four stories of ordinary joisted brick construction on Washington Street, connected to a fire-resistive building on Main Street by a one-story fire-resistive and ordinary-joisted section in the center without fire walls. The fire-resistive building on Main Street was of unprotected steel construction with floors of terra-cotta flat tile arches, side construction.

The Washington Street building (No. 556, in which the fire was first observed) ignited through unprotected openings in the rear wall, which is in line with the rear wall of the building where the fire started. The heat was driven by wind and water against the Main Street buildings, and against a four-story wall across the south side of the court. This probably produced a chimney type of draft, and the swirl of heat

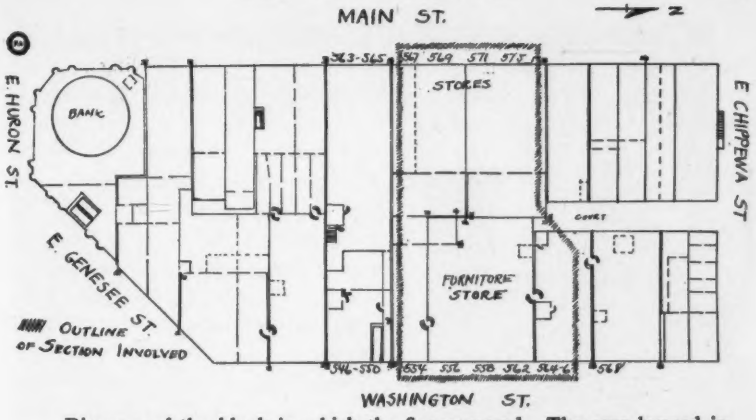


Diagram of the block in which the fire occurred. The area burned is outlined.

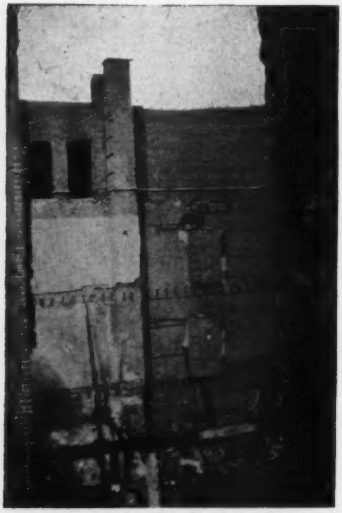
and flame ignited the three upper floors of No. 554 Washington Street. These upper floors which had been occupied by a social club were badly burned out.

The fire wall of this building on the north and directly exposed to the main fire, held perfectly. It is interesting to note that the stairs from street to the first floor of No. 554 were in No. 556. They were protected by a wood stud and metal lath and plaster partition, which held splendidly, as well as the single, standard 3-ply sliding fire door which was on the fire wall inside of the metal lath and plaster partition.

The second and third floors as well as part of the first floor of the fire-resistive building at Nos. 567-569 Main Street were occupied by a piano company for piano and musical instrument sales. The upper two floors ignited by direct exposure.

The first floor of No. 567 Main Street and 554 Washington Street was occupied straight through by a shoe store, and the fire communicated to this floor in a rather peculiar manner. Between the Main Street and Washington Street sections is a one-story connecting section with several large skylights protected by wire screens in all cases and both wired glass and wire screens in two skylights. The west and rear wall of 556 Washington Street crashed through one of these skylights and carried burning debris through into the shoe store, igniting the furniture and fixtures directly under. The fire spread along the shoe stock on both walls, and the flames therefrom evidently vented up one of these same skylights, thus saving a considerable building loss on this floor. It is possible, however, that the heat could also have ignited this lower floor as, while the metal screens were left intact over three of the skylights, the wired glass in one melted and became ineffective, and all of the clear glass was destroyed.

It seems right to recognize the splendid performance of the metal frame wired glass windows in the north wall of the building at Nos. 563-565 Main Street, which extends through to 546-550 Washington Street. This thirty-foot piece of wall, facing the light court, had several metal frame and wired glass protected openings on each floor, and was subjected to intense heat, evidenced by the spalling of the brick in the wall. But the wired glass held and, while cracked and crazed with heat, the flames were excluded from the building.



View of the fire wall referred to in the accompanying story. Fire entered the two unprotected openings on the fourth floor of Nos. 564-566 Washington Street, but the standard fire doors kept it out of the lower floors of the adjoining building.

Nos. 564-566 Washington Street, a four-story brick, ordinary wood joisted building north of the building where the fire started and communicating therewith on the second and third floors by openings protected by double, standard fire doors, suffered a considerable loss on the fourth floor by reason of two unprotected windows in fourth floor of Nos. 564-566 over roof of the original fire. The present view of this fire wall presents a splendid example of standard wall opening protection and none. Had two window openings in the fourth floor of Nos. 564-566 been protected, the loss therein would have been confined to the usual small smoke and water loss of the protected wall openings.

No. 568 Washington Street, a fire-resistive retail furniture store, four stories in height, suffered some water damage through one protected wall opening to No. 566 on the fourth floor.

Nos. 571-575 Main Street was a five-story, semi-mill construction building, occupied by a clothing sales company. The fire ignited this building by exposure, via unprotected windows on the west wall of 556-562 Washington Street to unprotected openings on east wall of this clothing store, all windows of which were unprotected on second to fifth floors. This wall took the brunt of the exposing heat. The wall is badly spalled, and several piers between windows are badly cracked. The wall from the second floor up will no doubt require rebuilding. The stock loss on the second floor and above is total, but the building structure other

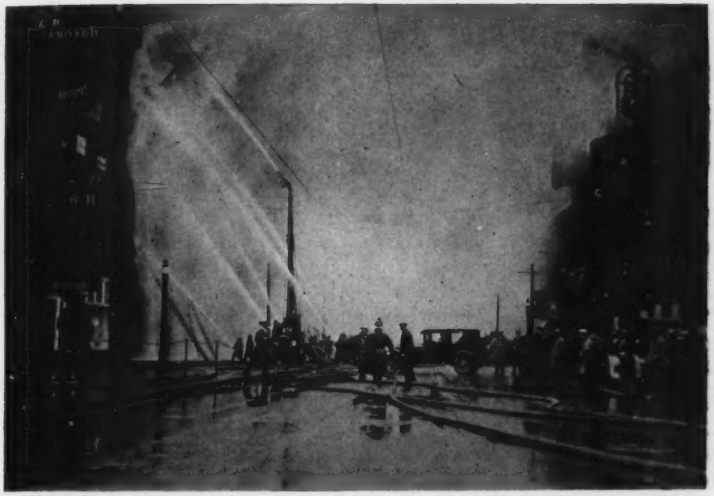


Photo by Underwood & Underwood.

Fighting Buffalo's first four-alarm fire in 26 months. The fire did damage estimated at $500,000 to a section of a block bounded by Chippewa, Washington, Huron and Main Streets. The above view is taken on Main Street.

than the east wall resisted in splendid manner. The internal floor construction was semi-mill, heavy columns, girders and beams, and 3-inch plank floors with 1-inch surface flooring. All internal members and floors were protected "for appearance" by metal lath and plaster, tight against woodwork, and, considering the fire, the loss to this internal structure was relatively small.

The first floor of the clothing store building was the least damaged. The fire communicated thereto by non-standard skylights in one section which failed to resist the heat by reason of the absence of wired glass and by downward communication through unprotected floor openings.

Conclusions

The undesirable features which deserve recognition are the absence of saddles at fire wall communications; the lack of standard wired glass in skylights; unprotected wall openings; the usual failure of steel columns under heat; the failure of side construction tile arches in floors; absence of watchmen in any of the badly damaged buildings; absence of any sprinkler protection where such an accumulation of highly combustible stocks was housed in buildings of old and combustible construction.

The commendable features are the resistance of metal frame and wired glass protected wall openings in exposed fire walls; the protection afforded woodwork by metal lath and plaster; the resistance afforded by

metal lath and plaster protection on wood studs for stair enclosures; the splendid performance of standard fire wall protection; and the value of semi-mill construction.

The fire brought out a large part of the fire fighting force of the city. The water supply was ample.

Nahant, Mass., Conflagration.

June 11, 1925

The Bass Point section of Nahant, Mass., was wiped out by a conflagration on June 11, 1925, about fifty summer cottages being consumed before a fireboat sent from Boston arrived to supply sufficient water to combat the fire successfully.

"Fireworks" was first given as the cause of the fire, it being reported that firecrackers were being discharged about 1:00 A. M. in the boys' club house in which the fire started, but the investigation made by the state fire marshal's office is inclined to assign the cause to cigarettes.

Whatever the cause, fire broke out in the early morning hours and, fanned by a strong breeze, spread rapidly from house to house, the small local fire department being unable to cope with it. With the arrival of

Wide World Photo.

A view showing a small part of the burned-over area at Nahant. The steel garage seen at the left, while slightly warped at the doors, could still be used. The destruction of every other building touched by the fire was complete.

Cottages burning in the fire which swept through a considerable part of Nahant, Mass., a summer colony. This photograph shows the highly combustible construction of the buildings and the exposure caused by the district being so closely built.

assistance from the nearby Lynn fire department the first effective work of checking the fire began, although the Lynn firemen were seriously handicapped by lack of water. The supply available from the 28-year-old 4 and 6-inch water mains was only enough for a few feeble streams and there was no way in which the engines could get near enough to the ocean's edge to lay suction lines for their pumps.

Word, however, was received that a fireboat had been dispatched from Boston, and accordingly the Lynn department had its lines laid down to the water's edge and were ready to hook up with the boat's pumps as soon as she arrived. With this added assistance the out-of-town forces soon controlled the fire.

While lack of water prevented proper fire fighting, the seriousness of the fire is directly attributable to the low class of construction of the cottages—being light frame,—the fact that they were built closely together, and the presence of wooden shingle roofs. While many houses were fired by direct exposure, many that were well ahead of the actual flames caught from sparks lighting on the tindery roofs. Roofs not wooden shingled were for the most part covered with other low grade roofing materials. Most summer resort towns are of equally poor construction and many are worse off in the matter of fire protection;

the lessons of this fire could be profitably applied wherever similar conditions exist.

Two years ago Nahant adopted a building code which provides that buildings must set back five feet from a front boundary of the lot and must be separated by ten feet from the next adjoining house. No house less than twenty feet wide may be erected. Many of the burned cottages were built on 10 foot lots. The Board of Selectmen has announced, however, that new buildings in the burned area must conform to the code.

Welding Processes—Fire Record.

An analysis of 109 fires among N. F. P. A. records which were caused by welding equipment very clearly points out that the fires were due to one of two outstanding conditions: either the apparatus was itself defective or else the fire was due to the proximity of some hazardous or combustible material.

The processes under consideration are those involving the use of electric welding equipments, or oxy-acetylene welding devices. Under the latter classification are included oxy-acetylene cutting torches. The oxy-acetylene equipment, either because of its more general use than the electric type of welder, or because of its greater hazard, or both, caused the greater number of the fires on record:

Fires by Type of Apparatus.

	No. Fires	Per cent
Electrical	16	15
Oxy-acetylene	93	85
	109	100

Of the electrical fires only one originated in the apparatus itself and this was in the case of a circuit breaker which failed to operate. Nearly half of the fires in connection with the acetylene apparatus started in the apparatus, however, which indicates that care is necessary in its design, construction and maintenance. Leaks were the leading cause of fires in the equipment, while explosion of the tank and mechanical injuries accounted for most of the rest.

By far the most serious cause of the fires was in the use of the welding and cutting devices near some hazardous or readily combustible material. Fire started usually because of sparks emitted during the welding or cutting process or by direct contact with the torch flame. A frequent happening was for sparks to lodge in wooden floorings, there to smoulder, breaking out after the close of the day's work. Another prolific source of fires was in the use of welding or cutting apparatus on

or near tanks which contained or had contained flammable liquids. Because the apparatus was used too near certain readily combustible materials like cotton cloth, sisal, excelsior paper and rubbish, these were ignited, usually by sparks, and several serious fires ensued.

It is interesting to note that in 50 cases, first aid fire appliances of one kind or another were used. In 33 of these cases they were effective in extinguishing the blaze. In 17 cases other devices had to be employed to control the fire. Probably the effectiveness of the first aid equipment is due to the fact that in most of the cases there were workmen present when the fire started and who could apply the extinguishers or hand hose immediately. It might be reasonable to require that a 2½ gallon extinguisher or other suitable equipment be kept near at hand wherever welding apparatus is in use.

Causes of Fires—Electrical Welding.

	No. Fires	Per cent
Sparks ignited:		
Woodwork	4	25
Baled cotton	2	13
Oily waste	2	13
Burlap	2	13
Clothing	1	6
Leaking acetylene tank	1	6
Ruptured fuel oil line	1	6
Dip Tank	1	6
Bundle of Hauser	1	6
Failure of circuit breaker	1	6
	16	100

Because the fires in acetylene welding equipment itself, and fires caused by the equipment because of the presence of some additional hazard are so distinct they have been treated separately in the tables which follow.

Causes of Fires—Oxy-Acetylene Welding.

	No. Fires	Per cent
Fires in the equipment itself	29	31
Fires due to presence of combustibles	64	69
Total	93	100

Oxy-Acetylene Welding—Causes of Fires in Equipment.

	No. Fires	Per cent
Leaking valve or connection	11	38
Explosion of gas tank	5	17
Accidental breaks	4	14
Leaking tubing	3	10
Flashbacks	3	10
Failure of fusible plugs	2	7
Employee unscrewed needle valve	1	4
	29	100

Oxy-Acetylene Welding—Fires Due to Presence of Combustibles.

Hazard	No. Fires	Per cent
Woodwork	19	31
Flammable liquids (or empty tank)	8	13
Flammable fibres (cotton, sisal, etc.)	6	9
Gasoline	6	9
Cloth or clothing	6	9
Rubbish	4	6
Paint	3	5
Garages	2	3
Tar paper	2	3
Dust duct	2	3
Charcoal	1	1.5
Dry feed	1	1.5
Linoleum	1	1.5
Electric generator	1	1.5
Transmission rope	1	1.5
Rubber hose of welding apparatus	1	1.5
	64	100

Typical Fires.

S-23708. JULY 2, 1918, CHICAGO, ILL. METAL FURNITURE FACTORY. Fire was probably caused by a spark from an electric spot welding machine lodging in the crevice of the floor. The fire department was called and when they arrived they found the fire had been entirely extinguished by the two sprinklers which had operated. There was considerable water damage.

S-29611. DECEMBER 13, 1920, FORT EDWARD, N. Y. PAPER MILL. Fire started from an electric welding equipment which was being used to mend a broken piston guide on an engine. Five sprinklers operated and two hose streams were used to extinguish the fire.

S-38270. OCTOBER 5, 1924, CHILLICOTHE, OHIO. PAPER MILL. A mechanic was using an acetylene torch to loosen a set screw in the gear hub on one of the paper machines. All broken paper had been removed from the pit under the machine, but there was some oily paper and grease at the side of the machine and on the ends of the cylinder. This became ignited by a spark from the torch, and flashing up, set fire to the felts over which the flames quickly spread. Due to the rapidity of the fire and the height of the ceiling, nineteen sprinklers opened, which together with a line of hose, extinguished the fire. The loss was about $1,000.

S-39433. AUGUST 27, 1923, NEW YORK, N. Y. TENANT BUILDING. A spark from an electric welding machine set on fire a bale of cotton which was standing nearby. Two sprinklers operated and extinguished the fire. Loss was small.

H-20214. FEBRUARY 15, 1923, HEMPHILL, TEXAS. SAW MILL. The foreman and millwrights were preparing to make a weld on the frame

of a core gear driving the edgers. An oxy-acetylene gas welding equipment had been taken into the mill for this purpose, and no sooner had the torch been lighted when the hot flames ignited, either grease on the gear wheels, or perhaps fine dust, but most likely the grease. The flames instantly flashed upward through the belt holes in the saw floor to the edger, and fed by the grease usually to be found around such machines, even under the most careful supervision, were almost instantly beyond control. The mechanic who intended to make the weld was severely burned on his hands and ears before he could jump away from the flames. The saw mill and machine shop were totally destroyed.

S-19350. April 2, 1916, Chicago, Ill. Electrical Appliances. Fire occurred in premises of a concern manufacturing electric arc headlights and generators for locomotives. Oxy-acetylene welding is done here and it is thought that a small spark fell in a crack of the floor just before closing time and smouldered in the dust until it finally set fire to the surrounding tables, railing and the floor. Three sprinklers operated and entirely extinguished the fire. Loss was about $3,000.

S-22768. January, 1918, Monessen, Pa. Rolling Mill. Steel plates were being welded by means of an acetylene welding apparatus located on a slightly raised platform. It was not noticed that the burnings from the welding process were passing through the cracks in the platform and falling upon the power transmission ropes underneath the platform. These ropes being impregnated with oil and in a stationary position readily took fire and when discovered they were burning for several yards in either direction. Two hose streams were used and the fire was extinguished in a few minutes.

H-18524. April 15, 1922, Goldsboro, N. C. Saw Mill. An electric welding set had been used during the day in repairing some outside glue tanks. This was discontinued at 5 P. M. and the operator placed the welding set on a shelf within the mill building. He removed his oily clothing and placed it in a well ventilated wooden locker about ten feet from the welding set. At 10:40 P. M. employees on duty discovered a small blaze in the locker where the oily clothing had been placed. It is assumed that sparks from the welding set became lodged in the oily clothing of the operator and smouldered until some slight breeze fanned it into a flame. The fire spread very rapidly and part of the roof of the mill building fell in before the fire department arrived. The loss on the building was $65,000.

H-19403. October 13, 1921, Brooklyn, N. Y. Dry Dock and Ship Repair Yard. Men who were at work on repairs to a ship lying alongside of dock were burning off plates with an oxy-acetylene torch. Sparks falling from the torch ignited oil floating on the surface of the water and spread to the under side of the pier. The public fire department,

summoned by an employee some distance away, had the fire extinguished before the men who were working on the job were aware of the fire. Damage, which was confined to the pier and cables under the piers, amounted to $1,055.

H-19446. NOVEMBER 11, 1922, CHESTER, PA. SHIPYARD. While a tank steamship was undergoing repairs at a dry dock an explosion occurred. Investigation disclosed that repairs were being made in a "summer tank." This tank had been cleaned and declared gas free. There were a few workmen on the boat who were burning out rivets and getting ready for the workmen to come that morning, and the explosion was undoubtedly caused by the torch. Either some flammable vapor came through the open valve which lead into the main tank, or in burning out a rivet hole on the bulkhead between the summer tank and the main tank, a flame from the torch went through the bulkhead. As the man was killed and everything in the vicinity was wrecked the exact cause could not be determined, but it was undoubtedly from this man's torch. The estimated damage was $225,000.

H-19470. MARCH 24, 1923, MADISON, KANSAS. GARAGE. Fire occurred while a mechanic was welding a fuel oil tank on an automobile truck. The cap over the vent opening was not removed and the formation of gas caused by the welding resulted in the explosion. The mechanic was burned to death and five others sustained serious burns. Loss on the building, which was practically destroyed, amounted to $18,000.

H-21969. FEBRUARY 16, 1925, TONAWANDA, N. Y. TAR STORAGE TANK. Repair men were cutting a hole in the steel plate side of a very large empty tar storage tank with an oxy-acetylene cutting torch. The tank sides are said to have been practically clean of tar, etc., as tank is said to have been cleaned with steam hose about a week before. However, there was no doubt a small amount of tar on the sides of the tank, and such materials as naphthalene and other organic products on the under side of the wood joist roof. A hole was being cut near the bottom but the pounding may have caused some of the naphthalene to fall from the roof and ignite from the torch, or some of the tar remaining on the side may have taken fire. The men doing the work do not know just how the fire started except that the flame ran up the side of the tank. The private fire brigade and employees extinguished fire with two private hose streams.

Lyceum Theatre Fire, Baltimore.

Report by C. V. Gordon, Engineer.

Association of Fire Underwriters, Baltimore City (Member N. F. P. A.).

An early morning fire, starting from an undetermined cause, seriously damaged the first floor of the new Lyceum Theatre in Baltimore, on April 25 and, spreading to the roof, caused its collapse. Fortunately, the building was empty at the time except for a watchman, who was in a remote part of the building when the fire started. Poor building construction made fire-fighting difficult and five alarms were sounded before the fire was brought under control.

Construction.

The building was four stories in height, with independent brick walls on all sides, and an ordinary tin covered roof. The floors over the lobby and in the dressing room portions were of ⅞-inch boards. There was a proscenium wall of 16-inch brick extending from the ground to four feet above the auditorium.

Occupancy.

The building was occupied as follows:

Basement—Boiler room, store rooms, musicians' room, ushers' rooms and store room for advertising matter.

First Floor—Lobby, manager's and ticket offices, auditorium, stage, dressing rooms.

Second Floor—A restaurant with dancing, balcony of auditorium and dressing rooms.

Third floor—Kitchen of restaurant, gallery of auditorium, movie booth, dressing rooms.

Fourth Floor—Vacant attic, fly gallery.

Protection.

There was a standpipe and hose system consisting of three 2½-inch standpipes, one hose rack in the auditorium, one on each side of the stage, one in the fly gallery and one in the basement, with 50 feet of 2-inch cotton rubber-lined hose and ¾-inch nozzles on each. The hose was apparently in poor condition.

On the stage there was a city fire alarm box. Standard first aid protection was supplied by 2½-gallon extinguishers and casks provided in a sufficient number to comply with requirements. Watchman and clock service was maintained with a portable clock and standard rounds.

Photo by Underwood & Underwood

Faulty construction was responsible for the spread of flames which caused the damage shown to the New Lyceum Theatre of Baltimore. The fire, of five-alarm proportions, fortunately occurred when the theatre was unoccupied.

Story of the Fire.

The fire started in the front portion of the basement, perhaps in the store room for advertising matter, and was probably caused by smoking or matches. The watchman discovered the fire after the last patrons of the restaurant had left at about 3:00 A. M. He was in the restaurant kitchen and was returning to the lower floors in order to start his 3:00 o'clock round and found the lobby filled with smoke. He proceeded outside and pulled a fire alarm box at 3:33 A. M., not using the alarm box in the building.

Apparatus to the extent of fifteen engine companies, four truck companies, a hose company and a water tower responded to this and succeeding alarms.

The fire extended into the enclosed space under the floor of the auditorium, which was of joist construction. This space ranges in height from about one foot at the stage to about four feet at the rear of the auditorium, with the ground underneath. The fire burned its way from the room where it originated under the lobby into this blind space which was not accessible and because of the dense smoke could not be located by

the fire department. The side walls, lath and plaster finished on the inside, were constructed with wooden studs. Steel columns supporting the roof so arranged as to leave a space between the inside plaster finish and the brick wall itself, formed flues on both sides of the building. The fire spread up these to the roof. If these blind spaces had not existed, the fire no doubt could have been confined to the basement. The roof was of wood framing and burned rapidly, dropping through to the auditorium and causing a large part of the damage. The fire did not spread through the upper stories of the lobby section nor into the stage section, except at the roof.

This fire must have gained considerable headway before the fire department was notified or before it was discovered. Because of the dense smoke the exact location could not be determined. Although there was sufficient apparatus and hose streams available, water could not be directed on the fire because of its inaccessible location, having burned from the room under the lobby to the blind space under the auditorium. Because of the old frame construction, the fire spread rapidly in this blind space to the side walls which formed flues to the roof. Numerous hose streams were directed into this basement and into the blind spaces in the side walls, but as it was practically impossible to cover all of these, the fire spread to the wood framed roof, which was also hard to reach, and this roof burned until it dropped from its supports to the auditorium floor, after which the fire was extinguished.

Bobbed Hair; Fire Record.

Careless use of an electric curling iron is given as the cause of the fire that destroyed The Breakers at Palm Beach recently. So bobbed hair is added to the constantly increasing permanent wave of fire hazards that endanger the lives of those who recklessly persist in stopping at hostelries built of wood and living in frame houses.

No lives were lost, the fire having started at 4 P. M. Four in the morning would have told another and tragical story, for the building burned like tinder. This is the third frame hotel to burn on this site. Now the Florida East Coast Railroad announces it will build a modern fire-resistive structure.

It takes some folks a long time to learn their lesson.

—*Building Economy.*

St. Paul Bridge Fire.

Report by John Townsend, Jr.
(Member N. F. P. A.)

Fire starting in the heavily creosoted timbers of a trestle of the Chicago and Great Western Railroad, on April 10, seriously damaged the new Robert Street bridge across the Mississippi River which was under construction at St. Paul, Minn. The cause has been variously reported as either careless handling of an acetylene torch or hot cinders from a passing train.

Whatever the cause, due to the creosoted timbers the fire had considerable headway when first noticed, and rapidly spread and was added to by the lumber falsework of the new steel bridge that was being built over the trestle. Much difficulty was experienced by the firemen in bringing water to bear on the structure in that they had to stretch hose upwards of 2,000 feet to effectively reach it. The new bridge was nearly 100 feet high and a high wind hampered the direction of hose streams. Damage was, however, limited to about $18,000 on the new bridge and under $10,000 on the C. & G. W. trestle. Both the railroad and the construction company feel that the St. Paul Fire Department did praiseworthy work in extinguishing the fire, considering the difficulties under which it worked.

Fires in Which There Was Loss of Life.

These notes are intended to point out typical conditions under which loss of life has occurred, that they may be known and guarded against.

Gasoline.

H-21873. CARLISLE BAY, BARBADOS, FEBRUARY 17, 1925. While drums of gasoline were being unloaded from a steamer a sling containing two drums broke and the drums fell back into the hold on to other drums. In the explosion and fire which followed four shore laborers were burned to death. It is impossible to determine the exact cause of the fire but it was probably due to one of the following causes: (1) one of the drums which fell may have burst and the gasoline may have ignited, (2) the vapor in the hold may have become ignited, or (3) the impact of the metal drums, following the breaking of the sling may have produced a spark which ignited the gasoline or the vapor in the hold and caused the explosion.

H-21934. BROCKTON, MASS., APRIL 12, 1925. A machine had run out of gasoline and some was being procured from another car. In the darkness difficulty was experienced in locating the place where the tank is filled. Some of the gasoline spattered on one of the men's clothing and somebody carelessly lit a match. Before the match could be extinguished, the man's clothing burst into flames and he was so badly burned that he died a short time after.

H-22137. ATLANTIC CITY, N. J., JUNE 11, 1925. Five people were reported as missing when a cabin cruiser was burned to the water's edge. The fire started from a cigarette butt thrown down a hatchway igniting gasoline and causing an explosion. When the explosion occurred most of the party were thrown into the ocean and it was about an hour before they were rescued and brought ashore. Of the party of 32, 27 were taken to the hospital and treated for burns and immersion.

Kerosene.

H-22075. FORT DODGE, IOWA, MAY 3, 1925. A woman was trying to start a fire in a range with a can of kerosene. She was holding the can when it exploded, throwing the burning oil all over her body. Her husband heard her cries but was unable to go to her aid on account of the flames which enveloped the room. The woman made an attempt to escape from the room, but fell prostrate on the floor. Her clothing was com-

pletely burned and the entire surface of her body and her hair were burned. She was taken to the hospital, where she died a few hours later.

H-22077. SHELTON, CONN., MAY 5, 1925. A mother of six children was fatally burned while starting a fire in her kitchen stove. She thought the fire was out and poured a quantity of kerosene on to the still smouldering fire which caused an explosion. Her dress ignited and her body was soon enveloped in a mass of flames. Two of the children went to the mother's aid and succeeded in extinguishing the flames. She was taken to the hospital where she died the next day.

H-22135. HOLLISTON, MASS., JUNE 4, 1925. A woman was about to pour kerosene on the kitchen fire to hasten supper when she tripped over a rug. The spilled kerosene had drenched her clothing and it caught fire. Her nine-year-old son tried to save his mother by smothering the flames with an old coat, but she was seriously burned before he could put out the blaze. She died the following day.

Kerosene Lamp.

H-21898. MILFORD, CONN., MARCH 14, 1925. A mother, who had arisen early to prepare breakfast for one of her sons, retired again, leaving a kerosene lamp burning in her room. The son, while waiting for a car, saw the flames and rushed back to the house. He assisted his father, who was slightly burned, from the cottage and returned to rescue his mother. He was apparently suffocated and burned to death while trying to reach her. The bodies of both were found beside the bed. Another son escaped by leaping through a window and was badly cut by the glass.

Gas Stove.

H-22094. NEW YORK CITY, MAY 22, 1925. An aged woman was burned to death while preparing a birthday feast for her husband. She was working in the kitchen when her clothes caught fire from a gas stove. Her husband, hearing her screams, rushed into the kitchen and succeeded in beating out the fire, but not until she was fatally burned. He was himself badly burned.

Watchman Did Not Call Fire Department.

H-22125. NEW YORK CITY, APRIL 6, 1925. A car-barn fire, which employees tried to extinguish before calling the public fire department, resulted in the death of the watchman. The fact that the watchman was missing was not noticed until after the fire was extinguished. Firemen working in the wreckage of the burned cars found the night watchman, with his watchman's clock clutched in his hand. He was breathing, but unconscious. His skin was burned in places. He was rushed to the hospital where he died the next day from the effects of carbon monoxide poisoning.

Fireworks Factories.

H-21925. WEST HANOVER, MASS., APRIL 7, 1925. A spark, which probably came from friction of some kind, caused an explosion in a small building where an employee was mixing saltpeter, sulphur and charcoal. The man, who was working alone in the building, was instantly killed, so the exact details will never be known. Several others who were slightly injured jumped into the river to escape the fury of the powder flames and the exploding fireworks. Girl employees held their aprons and skirts over their faces and heads to save their flesh and hair from the hot blasts of flame which poured on them as they tried to escape. Many were scorched, while some were temporarily blinded and nearly overcome by the acrid fumes and smoke.

H-22136. CANTON, MASS., JUNE 4, 1925. An employee was working alone in a cement building filling toy bombs from a machine. He had just started his machine when an explosion occurred and he was blown about twenty feet from the building. His clothing was stripped from his body and he was burned so badly that he died the next day.

Dwelling House.

H-21924. BATAVIA, N. Y., APRIL 6, 1925. Two children were burned to death and nine other persons were injured when fire destroyed their home. The mother and father, who were sleeping on the ground floor, discovered the fire and ran upstairs to arouse the children. Their retreat by way of the stairs was cut off by the flames. The oldest daughter threw several of the smaller children out of a window and then leaped after them. Both the mother and father, who jumped from the window, were badly injured. The two children who died in the fire attempted to escape by way of the stairs. After the fire had burned itself out, their bodies were found in the ashes, burned beyond recognition.

Rooming House.

H-22059. AUSTIN, TEXAS, FEBRUARY 3, 1925. A fire which occurred in a rooming house near the State University caused the death of one of the students. He was awakened by his roommate, but delayed to find his glasses, for without them he was practically blind. He was forced to flee without them and losing his way out fell into the bathroom, where he was found by the firemen. He was badly burned and died before aid could be rendered.

Shingle Roof.

H-22048. PARK RIDGE, N. J., MAY 16, 1925. A nurse sacrificed her life for her patient when a fire, which is believed to have been caused by sparks from the chimney setting fire to the shingle roof, destroyed their home. The patient had just returned from the hospital and on account of

the cool weather a fire was kept burning in the fireplace in the patient's room. The caretaker, who lives nearby, heard the crackling of the flames and ran to the main entrance where he found two children standing near the steps. He started up the stairway to the second floor, but on account of the smoke and flames he was obliged to go back. He then secured a ladder and just as he got it in position at the window where the two women were standing, the sill broke into flames. The two women moved to another window, but just as the caretaker had the ladder adjusted and started to go up, the wing of the building collapsed. The two women were buried in the ruins.

Fire Fighting.

H-21907. NEWPORT, R. I., MARCH 24, 1925. Fire, which practically destroyed the City Hall building, caused the death of one fireman and serious injury to another. The fireman who was killed became dazed from the effects of smoke and fell down a flight of stairs. Another fireman sustained serious injuries when a part of the roof fell on him.

H-22043. ATLANTA, GA., MAY 6, 1925. Firemen were engaged in fighting a fire in a building used for the storage of cotton and miscellaneous articles. They were fighting the flames from the ground floor when the upper floor and the front wall of the building collapsed, burying them. It was necessary to dig in the debris to recover the dead and injured and it was some time after the fire was out before all the missing firemen had been accounted for. Then it was found that six men had been killed and five badly injured. The collapse of the floor was caused by the great weight of water soaked cotton. The structure had been damaged by a previous fire and the weakened supporting members not replaced. The burning of the floor beams was also a contributing factor.